making an impact

Semi-annual Impact Report

Swette Strategic Investment Fund

January 2019 - June 2019

Prepared by Bruce E. Rittmann
Director and Regents' Professor

ASU Biodesign Institute Arizona State University | Swette Center for Environmental Biotechnology

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Swette Center
for Environmental
Biotechnology

By using the building blocks of Nature's grand designs, our talented researchers have pushed the frontiers of knowledge and advanced research and discovery to make a major impact on our community, nation and the world.

The first half of 2019 saw continued forward momentum for The Biodesign Swette Center for Environmental Biotechnology.

This report highlights key advances that are paving the way for greater discoveries in the future.

We are most grateful for the generous support and confidence that the Swette family has provided. Without that help, these achievements would not have occurred.

The Swette Strategic Investment Fund has advanced our ability to create new solutions

The Swette Strategic Investment Fund has supported the Biodesign Swette Center for Environmental Biotechnology (Swette Center) as its researchers develop preliminary results, publish seminal papers, give talks across the world to enthusiastic audiences, and have time to seek funding for new projects. We have been fortunate in our ability to attract outstanding researchers and integrate them effectively into our team and our work. Their talents and inspiration is an ongoing source of ideas for traveling new paths and making new discoveries.

The Swette funds have been the fuel that has enabled us to take giant leaps in our search for solutions that will help the world create a more sustainable environment. Here are a few examples of projects that have gained traction due to the Swette funds:

Swette investments were made towards exploring and understanding the human intestinal microbiome. This resulted in a ground-breaking publication on the long-term benefits of microbiota transplant therapy for improving behaviors of children in the autism spectrum.

We also invested in our microbial photobioenergy team, which led to a ~$2-million grant from the Department of Energy to expand membrane carbonation for delivering industrial sources of CO_2 to enable high productivity with microalgae cultivation.

The Swette investment also allowed us to extend our work with membrane biofilm reactors to bioremediate waters contaminated with two challenging water contaminants: 1,4-dioxane and per-fluorinated alkanoic acid. We received two Department of Defense grants towards these goals.

OUR MISSION

The mission of the Biodesign Swette Center for Environmental Biotechnology is to manage microbial communities that provide services to society. Many of the services make our society more environmentally sustainable, for example, generating renewable resources and making polluted water and soil clean.

The microbial services also make humans healthier – directly and indirectly.

The Swette Center is noted for its culture of cross-disciplinary and team-based research. This culture begins with our researchers who come from diverse disciplines within engineering, life sciences, chemistry, and more.

The Center embraces systems thinking, sustainable engineering, and disruptive innovation. Partnerships are common within the different research groups in the Swette Center, other groups in ASU, national and international universities, and practitioners.

CENTER GOALS

I. BE THE LEADING GLOBAL CENTER IN ENVIRONMENTAL BIOTECHNOLOGY

A. Influence the Academic Community
B. Influence the General Public

II. PERFORM AND DISSEMINATE TRANSFORMATIVE SCIENCE AND TECHNOLOGY

A. Develop a Center roadmap that highlights areas of crossover between PIs and potential areas of new research.
B. Discover, manage and curate microbial metabolisms, pure cultures, and communities that provide services to the environment and humankind.
C. Conceive of and lead large, multi-disciplinary, multi-PI projects centered on harnessing our areas of expertise.
D. Provide a safe and innovative space for students and staff to further the goals of the Center and their own careers

III. PROMOTE SUCCESS IN OUR TEAM TO BECOME LEADERS IN THEIR AREAS

A. Provide career mentoring for students, postdocs, research scientists, staff, and research faculty.
B. Provide social support to promote bonding and a Center culture that produces highly productive research and researchers.
C. Consider appointing an Associate Director to assist with Center leadership as Dr. Rittmann devotes more time to global dissemination and partnerships and to ensure long-term leadership continuity.

MEASURES OF SUCCESS

Success can be measured in many ways:

Promotions	Poster Presentations	Spin-offs
Funding	Publications	Center Feedback
Awards	Proceedings	Courses
Career Progression	Invited Talks	Job Placements
Recruiting	Press Coverage	Collaborations
Commercialization	Scholar Diversity	Infrastructure
Patents	Outreach	Space
Graduates	Dynamic Road Map	Retreats

HIGHLIGHTS

Anca Delgado's paper received the AZ Water 2019 Quentin Mees Research Award. In March of 2019, Anca Delgado's paper "Coupling Bioflocculation of *Dehalococcoides mccartyi* to High-Rate Reductive Dehalogenation of Chlorinated Ethenes" was selected to receive the AZ Water 2019 Quentin Mees Research Award.

Outstanding Faculty Mentor 2018, The ASU Graduate College awarded BSCEB faculty member **Anca Delgado** with the 2018 Graduate College Outstanding Faculty Mentor award in the category Outstanding Masters Mentor for 2018. The committee received many exceptional nominations but her portfolio, which included strong letters of support from her students and faculty chair, impressed them the most. A reception honored Dr. Delgado and a cash prize helps to support her professional activities.

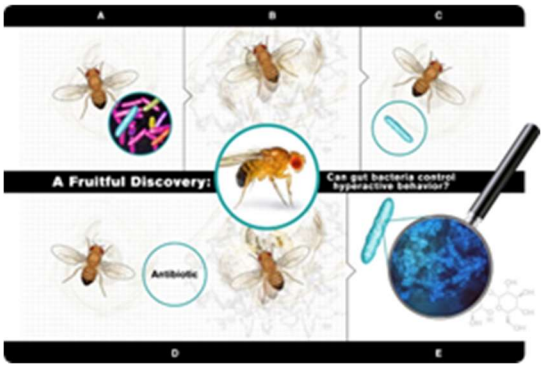
The AEESP Conference 2019, "Environmental engineers and scientists see cities in 4-D: The built environment, the natural environment, human health, and cyberspace," was hosted at Arizona State University from May 14-16, 2019. The organizing chair was **Treavor Boyer**. The organizing committee also included BSCEB members **Anca Delgado**, **Rosa Krajmalnik-Brown**, and **César Torres**.

Research by members of the **Rosa Krajmalnik-Brown** and James Adams programs at Arizona State University was featured in a new study, "Long-Term Benefit of Microbiota Transfer Therapy in Autism Symptoms and Gut Microbiota," published in Scientific Reports (April 9. 2019). The study demonstrates that Microbiota Transfer Therapy provides long-term benefits for children diagnosed with Autism Spectrum Disorder. ABC 15 Arizona picked up the story and featured Rosa Krajmalnik-Brown and **Daewook Kang** (April 29, 2019).

The Economist featured novel autism research, led by **Dr. Rosa Krajmalnik-Brown**, which restores missing gut microorganisms in patients with autism spectrum disorder and reduces symptoms. Read article HERE (May 30, 2019).

Dr. Krajmalnik-Brown was featured in a new Ask-A-Biologist podcast. Dr. Rosy was featured in the *Microbes Living Inside Us* podcast. Podcast Notes: On this program we talk a lot about cells. In particular plant, animal, and microbial cells. But did you know there is a world of microbes that

make their home inside and on our bodies? Before you start to worry, you need to know most of these microbes are important for us to live. In fact, without them we would not be here. This tiny world is the focus of Rosa Krajmalnik-Brown's research. It spans the microbes that live with us and those that are helping us clean up our environment. There is even a discussion about how poop is helping treat some people and that is something you don't usually get talk about (April 2019).



Dr. Rosa Krajmalnik-Brown reflected on recent Nature publication about implications of microbial symbiont influence over fruit fly behavior (Feb 7, 2019). In *Molecular Cell*, Dr. Rosa Krajmalnik-Brown discussed recent findings by Schretter et al. (2018). In her article titled *A Fruitful Discovery: Can Gut Bacteria Control Hyperactive Behavior*, she considers how these findings contribute to the emerging microbial metabolism-mediated gut-brain model on many levels and how the work can instruct future research efforts. Biodesign also covered the article, here.

Carlos Leyva developed a new sensor system for a mobile urinal platform to monitor pH, conductivity and temperature of a urine storage tank. The system can keep track of how many users donate urine and can add chemicals after every use. He also deployed more water quality sensing in the new Biodesign C building breakrooms and added new ones in ISTB4 breakrooms. All of these efforts contribute to ongoing efforts, in the **Treavor Boyer Lab**, to redirect urine from the waste stream, recover resources from urine, and remove contaminants from water.

Swette Center PhD Students Branching into Policy and Communications. PhD Student and Science Writer **Christine Lewis** is interning with Director of Biodesign Marketing and Communications Dianne Price, and published a story about her fellow Swette Center PhD students **Caitlyn Hall** and **Ethan Howley** who have organized a group of ASU delegates who traveled to the Arizona Capitol on Tuesday, 2/5 to urge lawmakers to reconsider and re-prioritize water conservation and reuse in Arizona. Read the full article, *Science Day at the Arizona Capitol*, here. This story embodies the many ways that our students are involved with the community and striving to make an impact outside of the lab.

Mikroscope is a podcast hosted by young Scientists and Academics who report on the latest news and discoveries in Environmental Science. The podcast is hosted by Swette Center member **Mike Pavia**, a first year Ph. D. student in Microbiology and member of the **Hinsby Cadillo Quiroz Lab**.
https://www.whateveryousayproductions.com/mikroscope

Dr. Bruce Rittmann commented on a study examining beneficial microbial communities in global wastewater sludges.

> *"This unprecedented global sampling effort yielded new insight into the microbiology of activated sludge," said Bruce Rittmann, director, Biodesign Swette Center for Environmental Biotechnology, Arizona State University."Despite giant geographic differences, the microbial communities of activated sludge have a core of about 28 bacterial strains, which reflects the powerful and unique ecological selection of the activated sludge process."* (May 13, 2019)
>
> – Smith, Jana. Study expands understanding of bacterial communities for global next-generation wastewater treatment and reuse systems, PhysOrg and ASU Now.

Dr. Bruce Rittmann was a co-author of the article Global diversity and biogeography of bacterial communities in wastewater treatment plants, *Nature Microbiology* (2019). DOI: 10.1038/s41564-019-0426-5 , https://www.nature.com/articles/s41564-019-0426-5

Matt Scholz contributed to Brownfield Ag News for America. "Phosphorus Sustainability Challenge Urges Groups to Reduce Phosphorus Footprint", April 9, 2019, https://brownfieldagnews.com/news/phosphorus-sustainability-challenge-urges-groups-to-reduce-phosphorus-footprint/ as well as launched the Sustainable Phosphorus YouTube Channel.

The **Bruce Rittmann Lab** partnered with the City of Mesa for a food to energy feasibility study. Postdoctoral Scientist **Michelle Young**, Masters Researcher **Rick Kupferer**, and Undergraduates **Riley Tesman**, **Veronica Ayala Bojorquez**, **Aamena Mookadam**, and **Sam Utley** are all part of a project that hopes to divert food waste from landfills into anaerobic sludge digesters that contain microbes that can transform it into a renewable energy source, biogas. Biogas can be cleaned up to become renewable natural gas, which powers the city's waste trucks! Members of the Rittmann Lab, at ASU's Biodesign Swette Center for Environmental Biotechnology, are optimizing operating parameters for this conversion process. Transforming waste to resources is one of our Center missions! (April 20, 2019) "Covering Mesa: Turning food waste into fuel." The City of Mesa, April 30, 2019,

Right, Postdoc Michelle Young collects fat-grease-oil from a local restaurant for waste-to-energy project.

Bruce Rittmann's Helium podcast advised introverts how to operate in extrovert settings and defeat imposter syndrome. Show Notes: How do you have to step up your ability to be outgoing in certain situations when you are working in academia? You might not expect a person in the National Academies for Engineering and Science to say that self-doubt still resonates at times. But Professor Bruce Rittmann can still get in touch with that feeling and identifies himself as shy. Dr. Rittmann shared his processes for practicing the outgoing role when he identifies as an introverted person. We also discussed his approach to funding, including some creative approaches he has taken to "kissing the frog." It was a privilege to have Dr. Rittmann on the show and we can all benefit from his seasoned approach to 45+ years in academia (March 26, 2019). https://teamhelium.co/. Helium Website Podcast Link

HELIUM

Bruce Rittmann spoke at the Asia-Pacific Research Excellence Summit. Bruce Rittmann was invited to speak on a panel *Water of the Future: Facing the Challenges* at the Times Higher Education 2019 Asia-Pacific Research Excellence Summit, held at UNSW, Sydney from February 19-21, 2019. The summit theme was *Research for the Public Good*. More than 270 global academics assembled to review university performance data pertaining to research quality, output and impact from universities across the Asia-Pacific region.

BIODESIGN INSTITUTE

The Biodesign Institute is a place unlike any other.

We assemble scientifically diverse teams to galvanize great ideas into real-world global solutions in state-of-the-art research laboratories at Arizona State University (one of the nation's largest public research universities) located in Tempe, Arizona. Whether it's seeking a cure for Ebola, removing toxic chemicals from air and water, or developing a diagnostic tool to assess widespread radiation exposure, the scientists at the Biodesign Institute take their cues from people and nature.

OUR APPROACH

We see things differently at Biodesign. Research begins with the identification of a real-world threat or opportunity and engages the best minds and resources.

- ***We illuminate threats*** … we identify and understand threats to our health, personal security and our planet
- ***We mobilize teams*** … our dynamic teams are interdisciplinary – involving biologists, chemists, engineers, statisticians, physicists, mathematicians, etc. – who look to nature for inspiration to solve today's grand challenges
- ***We shepherd solutions*** … we are committed to getting our research outcomes into the hands of those who need it most – through discoveries shared in publications, open science, products or spin-off companies.

OUR INSPIRATION

The ASU Biodesign Institute was not created in the image of a traditional research institute, with a rigid focus on a single field of study, but instead focuses on biological and nature-inspired solutions of public value. ASU is broadly inclusive in approach, advancing education for everyone.

THE BIODESIGN MODEL

Launched in 2003, the Biodesign Institute is organized into 16 research centers led by world-renowned scientific leaders and staffed by distinguished faculty, technicians and students from all over the world – all of whom are dedicated to providing real world solutions to today's global challenges.

OUR LEADERSHIP

Joshua LaBaer, MD, PhD

Executive Director, Biodesign Institute at ASU
Director, Biodesign Virginia G. Piper Center for Personalized Diagnostics, Professor, School of Molecular Sciences
Adjunct Professor of Medicine, College of Medicine, Mayo Clinic

ASU Biodesign Institute
Arizona State University

APPENDIX

For more information, visit the Center website: http://www.environmentalbiotechnology.org/

PUBLICATIONS

Jan-June 2019

R Allen, BE Rittmann, R Curtiss (2019). Axenic Biofilm Formation and Aggregation by Synechocystis sp. Strain PCC 6803 Are Induced by Changes in Nutrient Concentration and Require Cell Surface Structures. *Appl. Environ. Microbiol.* 85 (7), e02192-18.

NA Bokulich, J Maldonado, DW Kang, R Krajmalnik-Brown, JG Caporaso (2019). Rapidly processed stool swabs approximate stool microbiota profiles. *mSphere* 4 (2), e00208-19.

TH Boyer, D Saetta (March 25, 2019). Opportunities for Building-Scale Urine Diversion and Challenges for Implementation. *Acc. Chem. Res.* 2019, 52, 4, 886-895, DOI: 10.1021/acs.accounts.8b00614.

B Cahill, L Straka, JM Ortiz, R Krajmalnik-Brown, BE Rittmann (2019). Effects of light intensity on soluble microbial products produced by *Synechocystis* sp. PCC 6803 and associated heterotrophic communities, *Algal Research* 38, 101409.

LAG Godoi, RBS Guerrero, CED Santos, E Foresti, M Zaiat, MHRZ Damianovic (May, 2019). Rapid and easy quantification of elemental sulphur in aqueous samples from biological reactors: the turbidimetric method revisited. *International Journal of Environmental Analytical Chemistry*, 99(9), 809-823. https://doi.org/10.1080/03067319.2019.1616704

VVSR Gupta , RGV Bramley, P Greenfield, J Yu, MJ Herderich (2019). Vineyard soil microbiome composition related to rotundone concentration in Australian cool climate 'peppery' Shiraz grapes. *Frontiers in Microbiology*. doi: 10.3389/fmicb.2019.01607

DM Hondula, JL Sabo, R Quay, M Chester, M Georgescu, NB Grimm, et al (2019). Cities of the Southwest are testbeds for urban resilience, *Frontiers in Ecology and the Environment* 17 (2), 79-80.

T Kalinowski, K McClellan, TA Bruton, R Krajmalnik-Brown, EM Driver, et al (2019). Autonomous screening of groundwater remediation technologies in the subsurface using the In Situ Microcosm Array (ISMA). *Journal of hazardous materials* 367, 668-675.

DW Kang, JB Adams, DM Coleman, EL Pollard, J Maldonado, et al (2019). Long-term benefit of Microbiota Transfer Therapy on autism symptoms and gut microbiota. *Scientific reports* 9 (1), 5821.

F Karadagli, AK Marcus, BE Rittmann (June 2019). Role of hydrogen (H_2) mass transfer in microbiological H_2-threshold studies. *Biodegradation*, Volume 30, Issue 2–3, pp 113–125.

D Ki, R Kupferer III, CI Torres (2019). High-rate stabilization of wastewater primary sludge in a single-chamber microbial H 2 O 2 producing cell (sMPPC). *Environmental Science: Water Research & Technology.* DOI: 10.1039/C9EW00100J.

D Ki, R Kupferer III, CI Torres. (2, 2019). High-rate stabilization of primary sludge in a single-chamber microbial hydrogen peroxide producing cell. *Environmental Science: Water Research & Technology* 5, 1124-1131. DOI: 10.1039/C9EW00100J.

K Klicki, D Ferreira, D Hamill, B Dirks, N Mitchell, & F Garcia-Pichel. (2018). The widely conserved ebo cluster is involved in precursor transport to the periplasm during scytonemin synthesis in Nostoc punctiforme. *MBio*, 9(6), e02266-18.

R Krajmalnik-Brown (2019). A Fruitful Discovery: Can Gut Bacteria Control Hyperactive Behavior? *Molecular Cell* 73 (3), 395-397.

YJS Lai, A Ontiveros-Valencia, T Coskun, C Zhou, BE Rittmann (June, 2019). Electron-acceptor loadings affect chloroform dechlorination in a hydrogen-based membrane biofilm reactor. *Biotechnology and bioengineering* 116(6) 1439-1448. https://doi.org/10.1002/bit.26945.

Y Liu, YJS Lai, TS Barbosa, R Chandra, P Parameswaran, BE Rittmann (2019). Electro-selective fermentation enhances lipid extraction and biohydrogenation of Scenedesmus acutus biomass. *Algal Research* 38, 101397.

Q Lu, C Zhang, W Wang, B Yuan, Y Zhang, BE Rittmann (2019). Bioavailable electron donors leached from leaves accelerate biodegradation of pyridine and quinolone. *Science of the Total Environment* 654, 473-479.

PL Lv, LD Shi, Z Wang, B Rittmann, HP Zhao (2019). Methane oxidation coupled to perchlorate reduction in a membrane biofilm batch reactor. *Science of The Total Environment* 667, 9-15.

ST O'Donnell, BE Rittmann, E Kavazanjian Jr (2019). Factors Controlling Microbially Induced Desaturation and Precipitation (MIDP) via Denitrification during Continuous Flow. *Geomicrobiology Journal*, 36: 543-558. (DOI.org/10.1080/01490451.2019.1581858).

E Rauh, MJ Scholz, R Muenich (April 1, 2019). A Compendium of Regulated Concentrated Animal Feeding Operation (CAFO) Manure Land Application Regulations. Available at http://bit.ly/manurecomp.

E Rauh, MJ Scholz, R Muenich (April 1, 2019). A Compendium of Biosolids Land Application Regulations. Available at http://bit.ly/biosolidscomp.

D Saetta, A Padda, X Li, C Leyva, PB Mirchandani, D Boscovic, TH Boyer (Mar 19, 2019). Real-time monitoring and control of urea hydrolysis in cyber-enabled nonwater urinal system. *Environmental Science & Technology*. 19;53(6):3187-3197. DOI: 10.1021/acs.est.8b06126

G Sharon, NJ Cruz, DW Kang...R Krajmalnik-Brown et al (May 30, 2010). Human gut microbiota from autism spectrum disorder promote behavioral symptoms in mice. *Cell* 177, 1600-1618. https://doi.org/10.1016/j.cell.2019.05.004

A Solanki, TH Boyer (2019). Physical-chemical interactions between pharmaceuticals and biochar in synthetic and real urine. *Chemosphere* 218, 818-826.

L Straka, BE Rittmann (2019). Growth kinetics and mathematical modeling of *Synechocystis* sp. PCC 6803 under flashing light. *Biotechnology and Bioengineering* 116 (2), 469-474.

L Wu, D Ning, B Zhang, Y Li, P Zhang, X Shan, Q Zhang, M Brown, Z Li, et al (May 13, 2019). Global diversity and biogeography of bacterial communities in wastewater treatment plants. *Nature Microbiology*, https://doi.org/10.1038/s41564-019-0426-5.

C Yu, S Qiao, Y Yang, R Jin, J Zhou, BE Rittmann (2019). Energy recovery in the form of N2O by denitrifying bacteria. *Chemical Engineering Journal* 371, 500-506.

J Yu, LM Deem, SE Crow, JL Deenik, CR Penton (2019). Comparative Metagenomics Reveals Enhanced Nutrient Cycling Potential After Two Years of Biochar Amendment in a Tropical Oxisol. *Applied and Environmental Microbiology* 85(11): e02957-18. doi: 10.1128/AEM.02957-18

Y Zhang, Y Wang, Q Lu, C Zhang, N Yan, Y Zhang, BE Rittmann (2019). The role of ultrasound-treated sludge for accelerating quinoline mono-oxygenation. *Journal of environmental management* 233, 561-566.

X Zheng, C Zhou, Z Liu, M Long, YH Luo, T Chen, A Ontiveros-Valencia, et al (Sep 2019). Anaerobic biodegradation of catechol by sediment microorganisms: Interactive roles of N reduction and S cycling. *Journal of Cleaner Production* 230, 80-89. https://doi.org/10.1016/j.jclepro.2019.05.058.

N Zhong, M Chen, Y Luo, Z Wang, X Xin, BE Rittmann (2019). A novel photocatalytic optical hollow-fiber with high photocatalytic activity for enhancement of 4-chlorophenol degradation. *Chemical Engineering Journal* 355, 731-739.

C Zhou, A Ontiveros-Valencia, R Nerenberg, Y Tang, D Friese, R Krajmalnik-Brown, and BE Rittmann (2019). Hydrogenotrophic Microbial Reduction of Oxyanions with the Membrane Biofilm Reactor. *Frontiers in Microbiology* 9: article 3268. doi: 10.3389/fmicb.2018.03268

Y Zhou, YJS Lai, E Eustance, S Xia, BE Rittmann (2019). Phosphate depletion controls lipid content and accumulation of heterotrophic bacteria during growth of *Synechocystis* sp. PCC 6803. *Applied microbiology and biotechnology*, 1-8.

Y Zhou, YJ Lai, E Eustance, and BE Rittmann (2019). Promoting *Synechocystis* sp PCC 6803 harvesting by cationic surfactants: alkyl-chain length and dose control the release of extracellular polymeric substances and biomass aggregation. *ACS Sustainable Chemistry & Engineering* 7: 2127-2133.

Y Zhou, AK Marcus, L Straka, E Eustance, YJS Lai, S Xia, BE Rittmann (2019). Uptake of phosphate by *Synechocystis* sp. PCC 6803 in dark conditions: Removal driving force and modeling. *Chemosphere* 218, 147-156.

Publications Accepted, But in Press

MG Edgar, H Ray, DG Grubb, L van Paassen, N Hamdan, TH Boyer (June 2019). Removal of Phosphate and Nitrate from Impacted Waters via Mineral Precipitation and Microbial Transformation. *Journal of Sustainable Water in the Built Environment*.

Y Liu; YJS Lai; BE Rittmann; in press, Increased anode respiration enhances utilization of short-chain fatty acid and lipid wet-extraction from Scenedesmus acutus biomass in Electro-Selective Fermentation, *Renewable Energy*

O'Donnell, S. T., C. A. Hall, E. Kavazanjian, and B. E. Rittmann (2019). A biogeochemical model for soil improvement by denitrification. *J. Geotech. Geoenviron. Engr.*

Xiong, J., M. N. Young, A. K. Marcus, S. W. Van Ginkel, and B. E. Rittmann (2019). Mathematical modeling and analysis of a wastewater treatment plant using the Cannibal® process. *J. Environ. Engr.* DOI 10.1061/(ASCE)EE.1943-7870.0001627.

Voth-Gaeddert, O. Torres, J. Maldonado, R. Krajmalnik-Brown, B. E. Rittmann, and D. B. Oerther (2019). Aflatoxin exposure, child stunting, and dysbiosis in the intestinal microbiome among children in Guatemala. *Environmental Engineering Science*.

J Xiong, MN Young, AK Marcus, SW Van Ginkel, BE Rittmann, accepted. Mathematical Modeling and Analysis of Wastewater Treatment Plant using the Cannibal® Process. *Journal of Environmental Science*, doi://10.1061/(ASCE)EE.1943-7870.0001627.

POSTERS

ML Altizer (May 15, 2019). “Microbial Consumption of H2 in Anaerobic Soils and Sediments: Detailing H2 Sinks and Stores.” Oral presentation at the Association of Environmental Engineering and Science Professors (AEESP) Conference, Tempe, AZ.

IB Peraza Baeza, HJ Honeman and C Wilber (May 2019). Implementation of introductory microbiology workshops using paper-based microscopes (Foldscopes®) in three communities in Yucatan, Mexico.

H Beria, S Khatami, CA Hall. "Meet the Experts: Transit Time in Hydrology". Session chaired at European Geosciences Union, Vienna, Austria, April 2019.

F Brown-Muñoz (November 30, 2018) "Gas Diffusion Layer (GDL) Optimization for Substrate-Loaded Underwater Microbial Fuel Cells (SLUMFCs)". Poster presented at the School of Engineering of Matter, Transport, and Energy Applied Project Symposium, Tempe, AZ.

D Calvo, CI Torres, HY Yang, R Lively, BE Rittmann; Volatile fatty acids production by anaerobic bacteria in a syngas-based Membrane Biofilm Reactor. Gordon Research Conference on Electron Donor-Acceptor Interactions. August 5-10, 2018. Newport, Rhode Island. **This poster was awarded a Gordon Research Conference Grant for graduate students for travel expenses.**

D Calvo, CI Torres, HY Yang, R Lively, BE Rittmann. Biofuel precursors by anaerobic bacteria in a syngas-based Membrane Biofilm Reactor. Biodesign Fusion Retreat. 2019. **This poster was awarded the Marie Curie Award for the Best use of Chemistry.**

NI Chan, MHeiling, JAdu-Gyamfi. (Jan 9, 2019). Phosphate oxygen isotopes in soil P fractions in Chernozem and Cambisol from lower Austria. Soil Science Society of America Annual Meeting. San Diego, CA.

T Davis, CA Hall, and BE Rittmann. (May, 2019) "Modeling In-Situ Permeable Reactive Barriers (PRBs) for Subsurface Acid Mine Drainage (AMD) Remediation". Association of Environmental Engineering and Science Professors, Tempe, AZ.

MG Edgar (May 17, 2019). "Removal of Phosphate and Nitrate from Impacted Waters via Mineral Precipitation and Microbial Transformation. Poster session presented at AEESP, Tempe, AZ.

MG Edgar (2018). "Removal of Phosphate and Nitrate from Impacted Waters via Mineral Precipitation and Microbial Transformation. Poster session presented at AZ Water, Tempe, AZ.

R Gruber, NI Chan, M Heiling, J Adu-Gyamfi, L Heng, G Dercon (April 12, 2019). Oxygen isotopes in phosphate to study soil P fractions and to trace sources of pollutants in agricultural catchment. European Geosciences Union – General Assembly 2019. Vienna, Austria.

CA Hall, ET Howley, C Barrett, and J Larson. (May, 2019) "Science Policy Curriculum by and for Early Career Scientists". Poster presented at the Association of Environmental Engineering and Science Professors, Tempe, AZ.

SG Hart, MY Young, BE Rittmann, P Parameswaran, CI Torres (May 16, 2019). "Different kinetic rate constant calculation methods give insights into the dynamics of batch anaerobic digestion at different loadings" Poster presentation at the Association of Environmental Engineering and Science Professors (AEESP) Conference, Tempe, AZ.

SG Hart, E Howley, H Ray, E Webb, A Handler, C Albin-Brooks, T Mor (May 15, 2019). "Teaching science in high-security prison units: How to design college curriculum for a challenging environment" Poster presentation at the Association of Environmental Engineering and Science Professors (AEESP) Conference, Tempe, AZ.

D Ki, SG Hart, CI Torres (May 16, 2019). "Microbial H2O2 producing cell (MPPC) as hybrid aerobic/anaerobic wastewater treatment system: operations and microbial interaction along with the produced H2O2" Poster presentation at the Association of Environmental Engineering and Science Professors (AEESP) Conference, Tempe, AZ.

NS Jagtap (May 15, 2019). "Improving N and K Recovery from Stored Urine." Poster session presented at the meeting of AEESP, Tempe, AZ

YJS Lai, A Ontiveros-Valencia, ZE Ilhan, YZhou, E Miranda, J Maldonado, R Krajmalnik-Brown, BE Rittmann (May 15, 2019) Enhancing biodegradation of C16-alkyl quaternary ammonium compounds and constraining antibiotic resistant genes using an oxygen-based membrane biofilm reactor. AEESP Research and Education Conference, Tempe, Arizona, Tempe, AZ

JN Levi (5/20/1029). "Nitrate Reduction Through Catalytic Hydrogenation." Poster presented at the NEWT annual meeting in Houston, TX.

S Mohana Rangan, I Ibrahim, AG Delgado,R Krajmalnik-Brown (May 2019). "Development of Microbial Enrichment Cultures for Detoxification and immobilization of Toxic Cr (VI)". Poster presented at AEESP Research and Education Conference, Tempe, AZ.

S Mohana Rangan, AG Delgado, R Krajmalnik-Brown (February 2019). "Rapid Reduction of Hexavalent Chromium by Microbial Culture Enriched from Contaminated Soil." Poster presented at the 8th Annual SSEBE Graduate Research Symposium, Tempe, AZ.

H Ray, F Perreault, TH Boyer, Nitrogen Recovery Fresh Urine by Forward Osmosis and Membrane Distillation. Poster presented at: National SESHA Conference: Scottsdale, Arizona, 1 May 2019. Received 1st place

H Ray, F Perreault, TH Boyer, Nitrogen Recovery Fresh Urine by Forward Osmosis and Membrane Distillation. Poster presented at: AZ Water Conference: Phoenix, Arizona, 16 April 2019. Received 1st place

H Ray, F Perreault, TH Boyer, Urea Recovery Fresh Urine by Forward Osmosis and Membrane Distillation. Poster presented at: AMTA Membrane Technology Conference & Exposition: New Orleans, Louisiana, 26 February 2019. Won best student poster

R Richard, D Saetta, C Leyva, R Dietz, A Padda, C Li, D Boscovic, P Westerhoff, TH Boyer (Jan 8, 2019). “Sensors Monitor Water Quality of New (Green) Lab Building.” Poster session presented at the meeting of AZ Water Research Symposium, Tempe, AZ

R Richard, D Saetta, C Leyva, R Dietz, L Crane, P Westerhoff, K Hamilton, TH Boyer (March 31, 2019). “What Affects Building Water Quality: Design or Occupancy?” Poster session presented at the meeting of Sustainable Water Management, Tucson, AZ.

R Richard, D Saetta, C Leyva, C Li, R Dietz, L Crane, P Westerhoff, K Hamilton, TH Boyer (March 6, 2019). “The Evolution of Water Quality in a New Green Building with Sensing Technology.” Poster session presented at the 15th Annual EPAZ Conference, Tempe, AZ.

R Richard, D Saetta, C Leyva, R Dietz, L Crane, P Westerhoff, K Hamilton, TH Boyer (May 15, 2019). “Online sensor technology to monitor water chemistry of new green laboratory building.” Poster session presented at the AEESP 2019 Research and Education Conference, Tempe, AZ.

R Richard, D Saetta, C Leyva, R Dietz, L Crane, P Westerhoff, K Hamilton, TH Boyer (April 18, 2019). “Year long water chemistry analysis and microbiology of a multi-story green building as move-in occupancy increases” Paper presented at the meeting of the 92nd Annual AZ Water Conference and Exhibition, Phoenix, AZ.

A Robles (May 16, 2019). "Microbial Chain Elongation Drives Complete Reductive Dechlorination of Trichloroethene." Poster session at the meeting of AEESP, Tempe, AZ

D Saetta, A Padda, X Li, C Leyva, P Mirchandani, D Boscovic, TH Boyer, (April 1, 2019). "Urine the cloud: Using sensing and actuation to transform nonwater urinal into “smart” urinal" Poster Session in the American Water Works Association Sustainable Water Management Conference, Tucson, Arizona.

LE Villarreal (August 31, 2018). Matthew Howard Kaufman (1942–2013). "Embryo Project Encyclopedia," https://embryo.asu.edu/pages/matthew-howard-kaufman-1942-2013.

M Young, R Kupferer, N Curley, T Sheber, E Auerbach, B Bubela, and BE Rittmann (May 2019). “Greening Municipal Waste Treatment: A Case Study of Using Food Waste and Fats, Oils, and Grease (FOG) to Improve Biogas Recovery from the City of Mesa’s Northwest Water Reclamation Plant.” Poster session at the Association of Environmental Engineering and Science Professors (AEESP) 2019 Research and Education Conference, Tempe, AZ.

C Zheng (5, 2019). "Catalytic and/or Biological Treatment of Ammunition wastewater treatment using H2-based Membrane Biofilm Reactors". Poster session at the meeting of the Association of Environmental Engineering and Science Professors, Tempe, AZ.

SYMPOSIA ORGANIZED

Delgado AG, Joshi S, Robles A. Exploring the metabolism of chain elongating microorganisms in soils. AEESP Research and Education Conference, Arizona State University, Tempe, AZ, May 2019

F Brown-Muñoz (November 9, 2018) "Gas Diffusion Layer (GDL) Optimization for Substrate-Loaded Underwater Microbial Fuel Cells (SLUMFCs)". [C. Gaedicke] (Chair), Engineering and Science Symposium conducted at the Society of Hispanic Professional Engineers National Convention, Cleveland, OH.

MG Edgar (2018). [T.H. Boyer] (Chair) AZ Water, Symposium conducted at the meeting of Tempe, AZ.

MG Edgar (2019). [T.H. Boyer] (Chair) AEESP, Symposium conducted at the meeting of Tempe, AZ.

Ki D, Kupferer III R, Torres CI (May 2019). Hydrogen peroxide production and primary sludge treatment in microbial fuel cells: a flux and rate analysis. Platform Presentation at AEESP Conference, Arizona State University, Tempe AZ.

INVITED PRESENTATIONS

JP Boltz. The Selenium, Sulfur, and Nitrogen Species Model for Flue Gas Desulfurization Used-Water Treatment. Electric Power Research Institute. Atlanta, GA, May 2019.

D Calvo. World Congress on Plant Science and Molecular Biology Valencia Spain, an organizing Conference happening on September 17-19, 2019

AG Delgado. The chemical and microbiological interface of organic pollutant remediation in soils. Environmental Engineering Seminar, Department of Civil and Environmental Engineering, University of California Irvine, Irvine, CA, May 2019.

SG Hart. Wastewater as a resource. Invited speaker at Science Day at the Arizona State Capitol organized by the Arizona Science Policy Network, Phoenix, AZ, February

CA Hall, N Mahabadi, E Kavazanjian, L van Paassen, and B Rittmann. (April, 2019) "Biogeochemical Reactive Transport Model for Denitrification-Driven Ground Improvement". Speaker at European Geosciences Union, Vienna, Austria.

CA Hall, E Howley, and C Barrett. (April 2019) "Bridging Early Career Scientists and Policymakers: Lessons Learned". Speaker at European Geosciences Union, Vienna, Austria.

EH Howley. Extracellular Electron Transfer in *G. sulfurreducens*: Lessons for transcriptomics in engineered systems. Invited speaker at AEESP 2019, Tempe, AZ, May 15, 2019


Seminar

Seminar, 12:30pm, Friend Center 004

May 9, 2019

Rosa Krajmalnik-Brown

Arizona State University

School of Sustainable Engineering and the Built Environment

Biodesign Swette Center for Environmental Biotechnology

Nature's Helpers: Hydrogen-Based Microbial Interactions for Successful Bioremediation

Abstract:

Bioremediation using microorganisms is a promising approach to remove organic and inorganic contaminants from soil and groundwater. For example, under anaerobic conditions, *Dehalococcoides* can reduce toxic chlorinated ethenes to ethene, an innocuous product, and gain energy for growth in the process. My laboratory devises microbial platforms to study microbial interactions in order to optimize remediation reactions. We look at competing processes present as part of the natural soil biogeochemistry in pristine and contaminated environments and study these processes through a combination of enrichment techniques, molecular microbial ecology (deep sequencing), water chemistry, and electron balances. Important microbial interactions for anaerobic remediation include those centered around hydrogen, such as interactions with methanogens and acetogens. We currently explore the importance of harnessing these interactions in contaminated and pristine sediments for successful bioremediation prediction. We have applied the knowledge gathered to: 1) enrich microbial dechlorinating cultures capable of some of the fastest rates of dechlorination for TCE to ethene reported, 2) successfully design and operate different types of continuous dechlorinating reactors, and 3) demonstrate that our approach can work at the field scale. Our successful outcomes are due to our multidisciplinary approach that links microbiology and engineering. The results gathered to date also provide fundamental understanding of microbial identification and enrichment techniques that we now apply to enrich microbes that can reduce chemicals such as Carbon Monoxide and Heavy metals.

PRINCETON

R Krajmalnik-Brown. Nature's Helpers: Hydrogen-Based Microbial Interactions for Successful Bioremediation. Princeton School of Engineering and Applied Sciences, together with the Department of Chemical and Biological Engineering, Special Seminar series, Princeton, NJ, May 9, 2019.

M Long, S Xia, Che Zhou, BE Rittmann. Complete dechlorination and mineralization of pentachlorophenol (PCP) in a hydrogen-based membrane biofilm reactor (MBfR). AEESP, Tempe, AZ, 5.14-5.16,2019

A Marcus. "Developing Mathematical Models of Microbes-Nanoparticle Interactions for Applications in Engineering and Human Health." Toulouse, France. June 21, 2019.

A Marcus. "Developing Mathematical Models of Microbes-Nanoparticle Interactions for Applications in Engineering and Human Health." Toulouse, France. June 24, 2019.

A Marcus. "Developing Mathematical Models of Microbes-Nanoparticle Interactions for Applications in Engineering and Human Health." Toulouse, France. June 26, 2019.

BE Rittmann. "From Treatment to Resource," GeoSyntec Annual Technical Conference, Scottsdale, AZ. January 25, 2019.

BE Rittmann. "From Treatment to Resource," AZWater Symposium on BioSolids, Phoenix, AZ. January 29, 2019.

BE Rittmann. "Water of the Future, Facing the Challenges," Times Higher Education Research Conference, Sydney, Australia. February 20, 2019.

BE Rittmann. "Atmospheric CO_2 Capture, Enrichment, and Delivery," Dept. of Energy BETO Conference, Denver, CO. March 7, 2019

BE Rittmann. "From Treatment to Resource," Tongji University, Shanghai, China. March 13, 2019.

BE Rittmann. "Prying Open the Black Box," Shanghai Normal University, Shanghai, China. March 13, 2019.

BE Rittmann. "How to Be a Successful PhD Student in Environmental Engineering," Tongji University, Shanghai, China. March 19, 2019.

BE Rittmann. "The Hydrogen-Based Membrane Biofilm Reactor (MBfR) for Reducing Oxidized Contaminants," Suzhou University of Science and Technology, Suzhou, China. March 20, 2019.

BE Rittmann. “Environmental Biotechnology and the Stockholm Water Prize,” Arizona State University Reception, Washington, DC. April 4, 2019.

BE Rittmann. “Minimizing Loss, Maximizing Benefits,” Sustainable Phosphorus Forum, Washington, DC. April 5, 2019.

BE Rittmann. “Innovation in the Water Industry,” AZWater Annual Conference, Phoenix, AZ. April 17, 2019.

BE Rittmann. “Maximizing the Value of Resources Recovered from Wastewaters,” Biofuels and Bioenergy Conference, San Francisco, CA. April 20, 2019.

BE Rittmann. “Maximizing the Value of Resources Recovered from Wastewater,” Biennial Conference of the Association of Environmental Engineering and Science Professors, Tempe, AZ. May 16, 2019.

BE Rittmann. “The Membrane Biofilm Reactor for Reducing Oxidized Contaminants,” Tongji University, Shanghai. May 22, 2019.

BE Rittmann. “How to Be a Successful PhD Student in Environmental Engineering,” Shanghai Normal University, Shanghai, China. May 24, 2019.

BE Rittmann. “Maximizing the Value of Resources Recovered from Wastewater.” Shanghai Environmental Conference, Tongji University, Shanghai. May 25, 2019.

BE Rittmann. “Biofilms on Active Substrata,” IWA Leading Edge Technology Conference, Edinburgh, Scotland. June 11, 2019.

D Saetta, A Padda, X Li, C Leyva, P Mirchandani, D Boscovic, TH Boyer, Urine 4D: Cyber-physical urine diversion system for urea hydrolysis control and water conservation, Association of Environmental Engineering and Science Professors Research and Education Conference, Tempe, Arizona, 14–16 May 2019, Track 7: Environmental Applications in Cyberspace II.

MJ Scholz. The Phosphorus Sustainability Challenge. Invited speaker at The Sustainability Consortium's Summit, Chicago, IL, May 7, 2019.

MJ Scholz. An Introduction to the Sustainable Phosphorus Alliance. Invited speaker at The Water Research Foundation's webcast, online, March 19, 2019.

MJ Scholz. The Phosphorus Sustainability Challenge. Invited speaker at Phosphorus Forum 2019, Washington, DC, April 5, 2019.

CI Torres (Jun 2019). Microbe Responses to Changes in Electrode Potentials: The 'Biofilm Anode' Concept. Invited Speaker at Gordon Research Conference in Bioelectronics at Andover, NH.

D Zhou. I have a presentation in CESF, Houston, US, June 2nd, 2019.

PATENTS

METHODS FOR TREATING AUTISM SPECTRUM DISORDER AND ASSOCIATED SYMPTOMS
J Adams, D Kang, R Krajmalnik-brown
US Patent App. 16/306,240

METHODS FOR TREATING AUTISM SPECTRUM DISORDER AND ASSOCIATED SYMPTOMS
J Adams, R Krajmalnik-brown, D Kang, MJ Sadowsky, A Khoruts, ...
US Patent App. 16/235,635

Biofilm media, treatment system and method of wastewater treatment
JP Boltz, GT Daigger, D Austin, B Johnson
US Patent App. 16/165,617

Microfluidic separation from water and direct optical detection of chlorine
PK Westerhoff, S Sinha, T Boyer
US Patent App. 16/146,160

TECHNOLOGY TRANSFER OUTPUTS (other)

Megan Altizer: Invention Disclosure. A method for measuring bioaugmentation potential. Megan Altizer, Anca Delgado, César Torres, Rosa Krajmalnik-Brown. Invention Id D19-109.

Matt Scholz: Released GIS-P, an online ArcGIS tool for navigating state and federal regulations of biosolids and manure land application and related datasets, available here: https://arcg.is/0KaCqX

DanDan Zhou is negotiating a Cooperation Agreement with a consulting company.

WORKSHOPS/CONFERENCES (attended, hosted)

In January of 2019, the BSCEB Leadership Team retreated for a day to revise our Center's goals and plans. A draft will soon be added to our website.

In April of 2019, the entire Center membership workshopped an Expectations Framework to guide mentor and researcher efforts in critical areas that we determined to be essential to our success, including Career Development and Mentoring, Communications and Meetings, Funding and Research, Integrity, Reading and Writing, Timelines, Advocacy and Conflict Resolution. A draft will soon be added to our website.

Sarah Arrowsmith: Organizational Excellence Community of Practice, May 2, 2019. ACS Webinar: Helium: An Irreplaceable Resource and Why We Must Conserve It, April 11, 2019.

ACS Webinar: How to Work Safely with Nanomaterials in the Laboratory, May 16, 2019. ACS Webinar: How to Improve Your Lab's Safety: Answering Your Questions, Feb 7, 2019.

Treavor Boyer: The AEESP Conference 2019, "Environmental engineers and scientists see cities in 4-D: The built environment, the natural environment, human health, and cyberspace," was hosted at Arizona State University from May 14-16, 2019. The organizing chair was Treavor Boyer. The organizing committee also included BSCEB members Anca Delgado, Rosa Krajmalnik-Brown, and Cesar Torres.

Caitlyn Hall: Rolf Hut, Niels Joost. (April 2019). FAIR Hydrological Models: Automated Comparisons Using eScience Tools. eWatercycle, Leiden, NL.

A Marcus (ASU) and S Marshall (Ultraworking) began a Work Cycles pilot program, BSCEB, April-July 2019.

MJ Scholz (Jan 23, 2019). "The Vermont Phosphorus Innovation Challenge". Online webinar hosted by the Sustainable Phosphorus Alliance.

MJ Scholz (4/10/19). "Phosphorus Sustainability Challenge Urges Groups to Reduce Phosphorus Footprint." Brownfield Ag News for America.

SUMMER PROGRAMS/INTERNSHIPS (attended, hosted)

Rachel Klein: ICLP, National Taiwan University, iclp@ntu.edu.tw, Summer 2019

Evelyn (Moni) Miranda: CBBG - Research Experience for Teachers

Srivatsan Mohana Rangan: Hosted "Research Experience for Undergraduates", Center for bio-mediated and Bio-inspired Geotechnics, Anton Sachs, amsachs1@asu.edu, May 27 - July 26, 2019.

Jeffrey Kyle Reep: Engineering Intern, Errol Montgomery & Associates Inc, Dennis Hall (dhall@elmontgomery.com), 12/17-current

Analissa Sarno: Tempe Dissertation Writing Camp, UASP, Darby Simpson, Darby.Simpson@asu.edu, June 17-21, 2019.

Lance Villarreal: Graduate Pathways, American Indian Student Support Services (AISSS), Laura Gonzales-Macias and 480-965-1711/lauragm@asu.edu, June 6 and 7, 2019.

GRADUATES

Francisco Brown-Muñoz, M.S., Chemical Engineering, Ira A. Fulton Schools of Engineering, Gas Diffusion Layer Optimization for Substrate-Loaded Underwater Microbial Fuel Cells, December 10th, 2018.

Gururaj Daptardar, M.S. in Chemical Engineering, SEMTE, Delivery of Ammonia Gas via Hollow Fiber Membranes, May 2019

Gandhar Pandit, M.S Environmental and Resource Management, The polytechnic School, Thesis title - Geo chemical Analysis of the leachate generated after zero valent metals addition to Municipal Solid Waste

Shefali Rao, M.S., Civil, Environmental and Sustainable Engineering, School of Sustainable Engineering and the Built Environment, May 2019.

Neil Rastogi, BS, Chemical Engr., May 2019, Project title: Electro-selective fermentation of Scenedesmus acutus algae for enhanced lipid extraction

Urusha Regmi, M.S., Civil, Environmental & Sustainable Engineering, Ammonium and Potassium Removal from Real Hydrolyzed Urine using Natural Zeolites, May 2019

Aide Robles: M.S., Environmental Engineering, Ira Fulton School of Engineering, Reductive Dechlorination Sustained by Microbial Chain Elongation, May 2019.

Carli Severson: B.S. in Medicinal Biochemistry and a minor in Sustainability. May 2019.

Lance Villarreal: B.S., Biological Sciences (Biomedical Sciences), School of Life Sciences, In Vitro Gametogenesis (IVG): Assisted Reproductive Technology (ART) in Development, May 6, 2019.

Theodora Yellowman: B.S., Biochemistry, Arizona State University, December 2018.

Diana Zermeno (B.S.),Chemical Engineering, School for Engineering of Matter, Transport, and Energy, Electrokinetic Transport to Enhance Enzyme-induced Carbonate Precipitation, May 2019.

JOB PLACEMENTS

Francisco Brown-Muñoz, Environmental Engineer, Arcadis, May 2019.

Everett Eustance: Promotion to Assistant Research Scientist, 1-1-19

Carole Flores: Title Change from Business Operations Manager to Financial Manager, Knowledge Enterprise Development at Arizona State University, 11 March 2019.

Shefali Rao, Junior Environmental Engineer, ARCADIS, July 2019.

Theodora Yellowman: Research Technician, Delgado Lab, Biodesign Swette Center for Environmental Biotechnology, Arizona State University, 12/31/2018.

Chen Zhou: Promoted to Assistant Research Professor in Summer 2019.

VISITING SCHOLARS

Renata de Bello Solcia Guerrero, PhD, University of São Paulo, Recovery of rare-earth elements and elemental sulfur from acid mine drainage, Bruce Rittmann, Chen Zhou, 1 September 2018 - 31 August 2019.

Zifang Chi, Ph.D., Associate Professor, Deputy Head in the Department of Environmental Engineering, Jilin University, Aerobic Cometabolic Degradation of Chlorinated Solvents using Ethane-based Membrane Biofilm Reactor (MBfR), Bruce Rittmann and Chen Zhou, 10/10/2018-10/9/2019

Gamze DOGDU OKCU, Post-Doc "Growth conditions affecting biomass competition for calcifying Emiliania huxleyi in a direct membrane-carbonation photobioreactor, ASU Decisive PROJECT", Y.J.S. Lai, E. Eustance are the mentors, B. E. Rittmann is the P.I, Visiting date: 01/03/2019

Liang Guo, Associate Professor, Ocean University of China, Phosphorus Distribution and Transformations of Microalgae at Different Feeding Operation, Bruce Rittmann and Treavor Boyer, 9/1/2018- 8/30/2019.

Daniel Hood, Science teacher, Mesa High School, Mesa, AZ, Anca Delgado Lab, Summer 2019.

Elie, Le Quéméner, Dr, INRA, Modeling of anaerobic microbial communities, Andrew Marcus, Jan. 30 2019-Oct. 31 2019.

Huai Li, Ph.D., Assistant Professor, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, NOx Bioreduction and Microbial Communities using C2H6 as Sole Electron Donor in a Membrane Biofilm Reactor, Bruce Rittmann and Chen Zhou, 10/10/2018-10/9/2019

Min Long, graduate student,Tongji,MBfR,Chen Zhou,2017.8.21-2019.8.21

Jundi Wang, School of Human Settlements and Civil Engineering, Jiaotong University, Xi'an PRChina, Combined chemical and microbiological approaches that enhance the remediation of the heavy fraction of petroleum hydrocarbons in contaminated soils. Anca G. Delgado, Oct. 25, 2018- Oct. 24, 2019.

DanDan Zhou PhD, School of Environment, Northeast Normal University, Changchun, China, Intimately Coupled Photobiocatalysis for Detoxification and Biological Mineralization of Recalcitrant Organic Wastewater Contaminants. Bruce Rittmann, Dec 2018 - Dec 2019. Chinese Scholarship awardee.

COURSES DEVELOPED/TAUGHT

Anca Delgado: EVE 452 Fundamental of Geoenvironmental Engineering, ASU School of Sustainable Engineering and the Built Environment. This junior/senior course introduces students to the topics of geochemistry and geotechnics, groundwater flow, and contaminant transport and fate in the environment. The course addresses environmental sources of

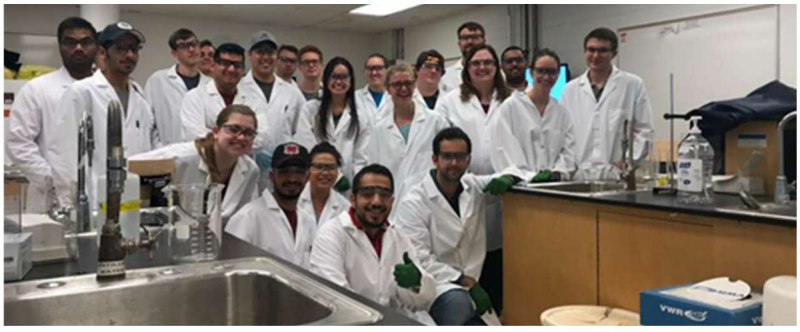
contamination, contaminated site characterization, risk assessment, in situ waste containment, and soil and groundwater remediation technologies. Soil and groundwater contamination and remediation topics are enhanced with case studies.

Carole Flores and Sarah Arrowsmith: Biodesign Swette Center Admin & Lab Onboarding Course, Canvas. A comprehensive introduction to the procedures, resources, and mission of our Center that promotes our culture, safety, research, and professional development.

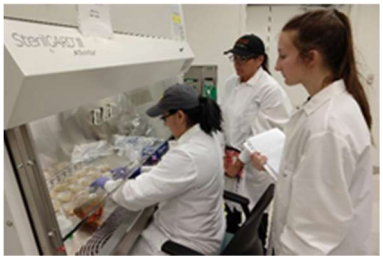
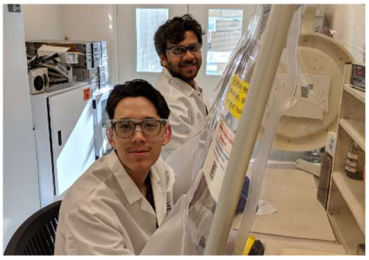
Anna Guerrero: BIO494, HPS 494, BIO 591, HPS 591, Scientific Illustration Summer Internship; An internship for undergraduate and graduate science and art students at ASU and other universities that teaches scientific illustration and freelancing skills. Work produced by the students will be published in the Embryo Project Encyclopedia, an online reproductive health and science encyclopedia for inclusive audiences.

Thiago Stangherlin Barbosa: Teaching assistant class CEE 361 – Introduction to Environmental Engineering, Spring 2019, Summer section A. I have taught 7 semesters the class CEE 361 – Introduction to Environmental Engineering as a Teaching Assistant, which includes the following activities:

- Teaching the Environmental Engineering Laboratory: Coagulation and Flocculation using the Jar Test teaching measurements: pH, alkalinity, turbidity. BOD5 for domestic wastewater. Hardness removal using lime and soda ash in the Jar testing; Air quality data collection and analysis for the Phoenix area.
- Teaching Recitation sections.
- Holding office hours.
- Preparing Students, Homework and Exam questions.
- Grading Lab Reports.
- Designing Environmental Engineering Lab Protocols.



MENTORING

Mentor	**Protege(s)** (UG = undergraduate, G = graduate, HS = high school, VS = visiting scholar)
Megan Altizer	Kaitlyn Alvarez UG, Renfei Zheng G
Francisco Brown-Munoz	Andrea Russell UG, Jianwei Zheng UG
Taylor Davis	Alana Florea UG
Blake Dirks	Randy Bravo UG, Debbie Chang UG
Everett Eustance	Samihan Dani HS, Tarun Shesh G
Cailyn Hall	Martina Ashley HST, Katie Currie HS, Lance Villarreal UG
Steven Hart	Kaitlyn Alvarez UG, Anna Guerrero G
Daewook Kang	Jigar Patel UG
Rick Kupferer	Austin Baker UG, Veronica Ayala Bojorquez UG, Abigail Johnson UG, Aamena Mookadam UG, Riley Tesman UG, Sam Utley UG
Yen-Jung (Sean) Lai	Joshua Phillips HS, Tarun Shesh G
Christin Lewis	Aaron Bozukluoglu UG, Huong Dang UG, Jennifer Lewis G, Anna Mangus UG
Yuanzhe Liu	Neil Rastogi UG
Yihao Luo	Xiangxing Long G
Evelyn Miranda	Daniel Hood HST, Kyle Reep UG, Carli Severson UG
Sri Mohana Rangan	Ibrahim Ibrahim UG, Shefali Rao G, Anton Sachs HS
Hannah Ray	Angela Egan UG
Rain Richard	Lucas Crane UG, Rebecca Dietz G
Analissa Sarno	Elias Rodriguez UG
Burcu Yavuz	Brielle Januszewski (FURI, UG), Melanie Hekeu VS
Michelle Young	Austin Baker UG, Veronica Ayala Bojorquez UG, Rick Kupferer G, Riley Tesman UG, Sam Utley UG

COLLABORATORS

Megan Altizer:

James Wang, Principal Environmental Engineer, Geosyntec Consultants, Electrokinetic Transport for Bioremediation and Mineral Precipitation, January-June 2019.

Josh Boltz:

Daigger, G.T., Professor, University of Michigan, Dept. Civil and Environmental Engineering. Predator Model Project, 2018-present.

Imre Takacs, President and CEO, Dynamita. SeSANS Model Project, 2018-present.

Piet Lens, Professor, University of New South Wales. SeSANS Model Project, 2018-present.

Rob Simm, Senior Vice-President and Chief Technology Officer, Stantec. SeSANS Model Project, 2018-present.

Diana Calvo:

Hector Luna. Universidad Antonio Narino. Bogota, Colombia. Started May 2019

Elie Le-Quemener. INCA France. Started May 2019

Jaime Plazas. Universidad de los Andes. Bogota, Colombia. Started March 2019.

Johanna Husserl. Universidad de los Andes. Bogota, Colombia. Starting October 2019.

Taylor Davis:

Steven Smith, Scientific Director, Translational Research Institute for Metabolism and Diabetes, NIH bioenergetics project, 2016-present.

Karen Corbin, Research Investigator, Translational Research Institute for Metabolism and Diabetes, NIH bioenergetics project, 2016-present.

Elvis Carnero, Postdoctoral Fellow, Translational Research Institute for Metabolism and Diabetes, NIH bioenergetics project, 2016-present.

Blake Dirks:

Shankar Thangamani, Midwestern University, "Antibiotic-induced gut metabolome alterations increase the susceptibility to Candida albicans colonization in the gastrointestinal tract", January - May 2019.

Joe Alcock, University of New Mexico, Circadian Rhythm of Salivary Microbiome, January 2019 - present.

Paul Ashwood, Cal Tech, CHARGE project, September 2018 - present.

Andrew Marcus:

Muriel Mercier-Bonin. Research Director. INRA, France. Developing the mechanisms of mucus-microbe-nanoparticle interactions. January to October, 2019.

Fatih Karadagli. Associate Professor. Sakarya University, Turkey. Mathematical modeling of the hydrogen threshold. 2019.

Evelyn Miranda: Freeport McMorRan - Sulfate Reducing Bioreactors - August 2018 - Ongoing

Srivatsan Mohana Rangan:

Neda Halalsheh, PhD student, New Mexico State University, Microbial Metabolic exploration for Bioremediation, January 2019 - Present.

OUTREACH EVENTS

Megan Altizer: Biodesign Night of the Open Door, Arizona State University, Volunteer, February 2019.

Francisco Brown-Muñoz, Noche de Ciencias at Gililland Middle School, Society of Hispanic Professional Engineers at ASU, Bilingual workshop lead, November 17th, 2018.

Diana Calvo:

Special seminar. Universidad de los Andes. Speaker. Aug 2019.
Special seminar. Universidad Antonio Narino. Speaker. Jul 2019.

Rebecca Dietz,

Guatemala Mission Trip, Global CHE/Living Word Chapel, July 2018
Mexico Mission Trip, Living Word Chapel, October 2018
SEE@ASU Event, Helper, June 2019
SEE@ASU Event, Helper, July 2019

Blake Dirks: Science Day at the Capitol, Arizona Capitol Building, ASU representative, February 5th, 2019.

Everett Eustance: ASU Open Door, 2-23-19

Juliana Levi: Night of the Open Door, ASU, volunteered with the prep, 2/23/2019

Evelyn Miranda:

ASU Open Door - Bioremediation Display - Explained bioremediation to visiting families

RECHARGE conference outreach event - Gave a Microscope demo to high school students interested in future engineering education.

Srivatsan Mohana Rangan:

Day of the Open Door, Biodesign institute, Volunteer, February 23, 2019.

RECHARGE Conference, ASU - West campus, Volunteer, February 20, 2019.

Bruce Rittmann:

January 25 – “From Treatment to Resource,” GeoSyntec Annual Technical Conference, Scottsdale

January 29 – “From Treatment to Resource,” AZWater Symposium on BioSolids, Phoenix, AZ.

April 4 – “Environmental Biotechnology and the Stockholm Water Prize,” Arizona State University Reception, Washington, DC.

Caitlyn Hall:

Biodesign Tour, May 2019, high school students with CompuPower

Arizona Science Day 2019, Caitlyn A. Hall, Ethan T. Howley, and Cassandra Barrett, Arizona State Capitol, Phoenix, AZ, February 2019.

Geology Prison Education Program, Teacher, Spring 2019.

Biology Prison Education Program, Teacher, Spring 2019.

On March 27th, we had a happy hour workshop with Joanna from the Union of Concerned Scientists with ~20 participants (photo included) on the Scientific Integrity Act and communicating your science to policymakers (in addition to her lecture in Caitlyn’s Spring class). Additionally, we have begun to set up a Science and Technology caucus at the Arizona Capitol.

Aide Robles: CompuPower SRE Visit, CBBG, Tour Guide, May 9 2019

Matt Scholz: Phosphorus Forum 2019, Role as Host, April 5, 2019.

Renfei Zheng: ASU Open Door, 2-23-19, SCEB

SERVICE ACTIVITIES OUTSIDE ASU

Josh Boltz:

WEF Research and Innovation Committee, Chair (current)
IWA United States of America (USANC), National Committee – Member (current)
IWA Biofilm Specialty Group Management Committee – Member (current)
WEF Municipal Wastewater Treatment Plant Design Committee – Member (current)
IWA Biofilms 2019: Biofilms and their interactions with surfaces – Scientific Committee (current)
IWA/WEF WRRmod2020 –Scientific Committee, Zurich, Switzerland (current)

Anca Delgado: Organizing Committee Member of 2019 Association of Environmental Engineering and Science Professors (AEESP) Research and Education Conference, Tempe, AZ, May 2019

Blake Dirks: Intel Science Fair, Judge for Microbiology, May 15th, 2019.

Everett Eustance: Algal Biomass Summit, Algal Biomass Organization, Biology Track Co-Chair for 2019 Conference Organization Committee, 2-1-19 to 9-20-19

Carole Flores: City of Phoenix Parks and Recreation Partner's Program, members of a day program for adults with developmental disabilities received a tour of our Center and research, 1/24/19.

Carole Flores: Legislative District 18 Precinct Committeeperson, monthly meetings, canvassing

Caitlyn Hall: Science Policy Advocacy for Scientists and Engineers, Caitlyn A Hall, Curriculum development and instructor, Spring semester 2019.

Rachel Klein:

Page Turners, Student Mentor, 2017-Present
Project Sunshine, Volunteer, 2018-Present

Hannah Ray: ASU Prison Teaching Program, Art Masterpiece at Sequoya Elementary School, Presented "Science As Art", 4/12/2019.

Mark Reynolds: ASU Biodesign Center for Fundamental & Applied Microbiomics Faculty Search - Graduate Student Representative

Rain Richard: Art Masterpiece at Sequoya Elementary School, Presented "Science As Art", 4/12/2019.

Bruce Rittmann:

Core Management Committee for the 2019 Leading Edge Technology Conference, sponsored by the International Water Association, Edinburgh, Scotland, June 10 – 13, 2019.

Chair of the Fellows Steering Committee, Association of Environmental Engineering and. Science Professors.

SSEBE Awards Committee Chair

Matt Scholz: RFP Development Committee, Hosted by The Water Research Foundation, Role as Technical Advisor, Jan-Mar 2019.

Lance Villarreal: Phoenix Fan Fusion, Brain Johnson, Panelist in "First Name Mister, Last Name Glass: The Unbreakable Trilogy", "I Kind DO Want to Live Forever: The Science of Aging", "Re-Writing Humanity: Gene Editing of Humans", and "A Shocking Revelation: The Science of Detective Pikachu" panels, May 24, 25, and 26, 2019.

Burcu Yavuz: Leads Zero Waste Initiative in the Swette Center

C Zheng. Association of Environmental Engineering and Science Professors, ASU, volunteer, 5/12/2019.

DanDan Zhou:

Association of Young Scientists of Environmental Society, China
Young Member of International Water Association, China

AWARDS

Megan Altizer: AZWater Scholarship, AZ Water, April 2019.

Sarah Arrowsmith: Sun Award, Feb 13 2019

Francisco Brown-Muñoz: Ed Pastor Outstanding Graduate Student Award, Watts College of Public Service and Community Solutions at ASU, December 12, 2018. Impact Award, Ira A. Fulton Schools of Engineering, December 10, 2018.

Diana Calvo:

I won a Block Grant from the School of Sustainable Engineering and the Built Environment at Arizona State University to continue her research on Fall 2019.

I won two grants with the two posters I presented:

Calvo, D., Torres, C.I., Yang, H.Y., Lively, R., Rittmann, B.E.; Volatile fatty acids production by anaerobic bacteria in a syngas-based Membrane Biofilm Reactor. Gordon Research Conference on Electron Donor-Acceptor Interactions. August 5-10, 2018. Newport, Rhode Island. This poster was awarded a Gordon Research Conference Grant for graduate students for travel expenses.

Calvo, D., Torres, C.I., Yang, H.Y., Lively, R., Rittmann, B.E. Biofuel precursors by anaerobic bacteria in a syngas-based Membrane Biofilm Reactor. Biodesign Fusion Retreat. 2019. This poster was awarded the Marie Curie Award for the Best use of Chemistry.

Samihan Dani: In January, Hamilton High School student Samihan Dani, working in the Swette Center with mentor Everett Eustance PhD on microalgae cultivation for bioproduct generation, was named one of the top 300 scholars in the 2019 Regeneron Science Talent Search. This prestigious math and science competition is one of the nation's oldest and has been sponsored by Westinghouse and Intel in the past. 40 finalists will be selected to participate in the Talent Institute in March 2019.

Anca Delgado: Outstanding Faculty Mentor 2018, The ASU Graduate College has awarded BSCEB faculty member Anca Delgado with the 2018 Graduate College Outstanding Faculty Mentor award in the category Outstanding Masters Mentor for 2018. The committee received many exceptional nominations but her portfolio, which included strong letters of support from her students and faculty chair, impressed them the most. There will be a reception to honor Dr. Delgado and a cash prize to support her professional activities. Congratulations!

Anca Delgado:
Special Congressional Recognition by U.S. Senator Martha McSally, Arizona, 2019
Quentin Mees Research Award, AZ Water Association, 2019
Graduate College Outstanding Faculty Mentor Award for 2018-2019, Outstanding Master's Mentor Category, Arizona State University, 2018-2019

Carole Flores: Team Builder Award Finalist, 2019 Knowledge Enterprise Employee Awards, ASU, May 2019.


Team Builder: Carole Flores, Financial Manager, KE-Biodesign Institute Finance

Anna Guerrero: Graduate Research Fellowship, National Science Foundation, 2019

Christine Lewis: PhD student Christine Lewis is the first winner of the Annual Veteran Recognition Scholarship from OurMilitary, based on an essay that she wrote and that they featured, "Persist and Conquer." The scholarship will help Christine complete her PhD, which seeks to bridge artificial and natural photosynthesis by employing the photosynthetic electron transport system.

FUNDED RESEARCH

ASU ID	Sponsor ID	Sponsor	PI	Title	Total $	Start	End
AWD00033797	1904126	National Science Foundation	Boyer	Workshop: Support for 2019 AEESP Research and Education Conference: Environmental	49,997	4/1/2019	3/31/2020
AWD00033532	401466-5801	Colorado School of Mines	Boyer	REGENERABLE RESIN SORBENT TECHNOLOGIES WITH REGENERANT SOLUTION RECYCLING FOR SU	95,399	9/6/2018	9/5/2019
AWD00033100	TBD	ASU Foundation	Boyer	Phoenix/Scottsdale Groundwater Contamination Endowment: Conference: 2019 Associat	10,000	7/1/2018	6/30/2019
AWD00032090	LTR 07/31/17	ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	Boyer	Core Project: Development of a Reactive Geocomposite Mat (RGM) Containing Steel Slag Fines and Organic Media to Remove Nitrogen and Phosphorus from	146,189	8/18/2017	7/31/2020
AWD00030931	1713704	National Science Foundation	Boyer	CAREER: Sustainable Urine Processes through integration of Education and Research (SUPER)	156,627	7/15/2016	12/31/2019

ASU ID	Sponsor ID	Sponsor	PI	Title	Total $	Start	End
AWD00033032	1749252	National Science Foundation	Cadillo	CAREER: Geochemical and functional controls of methane-mediating microbes in Amaz	650013	12/1/2018	11/30/2023

ASU ID	Sponsor ID	Sponsor	PI	Title	Total $	Start	End
AWD00029108		ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	Delgado	CBBG Core Project: Freeport McMoRan: Proposal for Passive Remediation of Acid Roc	82787	9/1/2018	8/31/2019

ASU ID	Sponsor ID	Sponsor	PI	Title	Total $	Start	End

AWD00029108		ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	Krajmalnik-Brown	Krajmalnik Brown - Microbial Metabolic Exploration PR16 ENV ASU	310403	8/1/2015	8/12/2019
AWD00029108		ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	Krajmalnik-Brown				
AWD00032554	LTR 022618	Finch Therapeutics Group	Krajmalnik-Brown	Enhanced Statistical Analysis of Phase 1 FMT Trial	219417	3/1/2018	9/30/2019
AWD00030736	R01 DK105829	HHS: National Institutes of Health	Krajmalnik-Brown	Integrating Quantitative Energetics Determines the Microbiome's Contribution to Energy Balance	2815848	9/1/2016	6/30/2020

ASU ID	Sponsor ID	Sponsor	PI	Title	Total $	Start	End
AWD00033918	AGR 051319	Xylem, Inc.	Rittmann	NEWT Non-Core Project - Reductive Defluorination and Mineralization of PFOA	121058	4/1/2019	3/31/2020
AWD00033582	DE-EE0008517	DOE: Office of Energy Efficiency and Renewable Energy (EERE)	Rittmann	Membrane Carbonation for 100% Efficient Delivery of Industrial CO2 Gases	1992766	10/1/2018	9/30/2020
AWD00033558	CW1517977/ PR23760915/ RPS4	Chevron Energy and Technology Company	Rittmann	RPS 4: Ozonation and Biodegradation Project	25000	7/1/2018	6/30/2019
AWD00033503	AGR 12/12/18	Stantec via Electric Power Research Institute	Rittmann	BIOLOGICAL TRANSFORMATION OF SELENIUM OXYANIONS: A MATHEMATICAL MODEL	25000	12/12/2018	6/30/2019
AWD00033471	AGR 11/15/18	City of Tempe	Rittmann	Co-digestion of Food Waste and Fats, Oils, and Grease (FOG) for Mesa, Arizona	76013	10/1/2018	9/30/2019
AWD00033324	CP0870	City of Mesa	Rittmann	Food Waste Digestion for Mesa, Arizona	113775	10/1/2018	9/30/2019
AWD00033027	10009615	Electric Power Research Institute	Rittmann	Mathematical and Process Model for Biological Transformation of Selenium	138033	7/16/2018	6/30/2019

				Oxyanions			
AWD00031653	1702445	National Science Foundation	Rittmann	Enhancing Biodegradation of Quaternary Ammonium Compounds (QAC)	379738	7/1/2017	6/30/2021
AWD00030280	1603656	National Science Foundation	Rittmann	SusChEM: COLLABORATIVE RESEARCH: Engineering the Hollow-Fiber Membrane Biofilm Reactor to Convert Syngas to Valuable Products	209022	7/1/2016	6/30/2020
AWD00028932	1509933	National Science Foundation	Rittmann	UNS: Targeted Saturated Fatty Acids Synthesis by Microbial Biohydrogenation and its Superior Extraction from Microalgae Biomass through Fermentation	309443	7/1/2015	6/30/2019

ASU ID	Sponsor ID	Sponsor	PI	Title	Total $	Start	End
AWD00033795	N00014-19-1-2125	DOD-NAVY: Office of Naval Research	Torres	Generating electrical power from blackwater using microbial fuel cells	112323	2/18/2019	2/28/2021
AWD00029428	N00014-15-1-2702	DOD-NAVY: Office of Naval Research	Torres	Combining Electrochemical - Omics and Microscopic Approaches to Characterize Transport Limitations in Anode-Respiring Bacteria Biofilms	448955	9/1/2015	5/31/2019
		DOD-NAVY: Office of Naval Research	Torres	Enabling 3D Fluorescence Imaging Under Anaerobic Environments			
AWD00029108		ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	Torres	Torres - Electrokinetic SubSurface Transport for Mineral Precipitation and Soil Remediation PR6 ENV ASU	311021	8/1/2015	8/12/2019
AWD00029108		ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	Torres	Torres - SUPP - Electrokinetic Facilitated Carbonate Precipitation PR43 ENV ASU	157445	7/1/2018	7/31/2020

making an impact

Semi-annual Impact Report

Swette Strategic Investment Fund

July 2019 – December 2019

Prepared by Bruce E. Rittmann
Director and Regents' Professor

TABLE OF CONTENTS

Swette Center
for Environmental
Biotechnology

By using the building blocks of Nature's grand designs, our talented researchers have pushed the frontiers of knowledge and advanced research and discovery to make a major impact on our community, nation and the world.

The second half of 2019 saw forward progress for the Biodesign Swette Center for Environmental Biotechnology.

This report highlights key advances that are paving the way for greater discoveries in the future.

We are most grateful for the generous support and confidence that the Swette family has provided. Without that help, these achievements would not have occurred.

The Swette Strategic Investment Fund has advanced our ability to create new solutions

The Swette Strategic Investment Fund has supported the Biodesign Swette Center for Environmental Biotechnology (Swette Center) as its researchers develop preliminary results, publish seminal papers, give talks across the world to enthusiastic audiences, and have time to seek funding for new projects. We have been fortunate in our ability to attract outstanding researchers and integrate them effectively into our team and our work. Their talents and inspiration are ongoing sources of ideas for new directions and new discoveries.

The Swette funds have been the fuel that has enabled us to take giant leaps in our search for solutions that will help the world create a more sustainable environment. Here are a few examples of projects that have gained traction due to the Swette funds:

Swette investments were directed towards exploring and understanding the human intestinal microbiome. This resulted in a ground-breaking publication on the long-term benefits of microbiota transplant therapy for improving behaviors of children in the autism spectrum, as well as major grants from NIH and the Department of Defense..

We also invested in our microbial photobioenergy team, which led to a ~$2-million grant from the Department of Energy to expand membrane carbonation for delivering industrial sources of CO_2 to enable high productivity with microalgae cultivation.

The Swette investment also allowed us to extend our work with membrane biofilm reactors to bioremediate waters contaminated with two challenging water contaminants: per-fluorinated alkanoic acid (PFOA) and 1,4-dioxane. We received two Department of Defense grants via the Nano-enabled Water Treatment (NEWT) Engineering Research Center towards these goals.

OUR MISSION

The Biodesign Swette Center for Environmental Biotechnology aims to be the **WORLD'S LEADING CENTER FOR ENVIRONMENTAL BIOTECHNOLOGY**. We are achieving this by producing fundamental and applied outputs that expand the horizon of environmental biotechnology. Our outputs include scientific concepts, technologies, and field-leading people. Taken together, they improve a broad range of human-generated and natural environments, inform the human-environment relationship, and promote a more sustainable future.

We manage microbial communities that provide services to society. Most of the services make our society more environmentally sustainable: e.g., generating renewable energy, and making polluted water and soil clean. The microbial services also make humans healthier – directly and indirectly.

CENTER GOALS

I. BE THE LEADING GLOBAL CENTER IN ENVIRONMENTAL BIOTECHNOLOGY

A. Influence the academic community
B. Inform the general public

II. PERFORM AND DISSEMINATE TRANSFORMATIVE SCIENCE AND TECHNOLOGY

A. Develop a Center roadmap that enables PIs to succeed in new research areas.
B. Discover, manage, and curate microbial metabolisms, pure cultures, and communities that provide services to the environment and humankind.
C. Conceive of and lead large, multi-disciplinary, multi-PI projects centered on harnessing our areas of expertise.
D. Translate research into new technologies that enhance sustainability.
E. Provide a safe and innovative space for students and staff to further the goals of the Center and their own careers

III. PROMOTE SUCCESS IN OUR TEAM TO BECOME LEADERS IN THEIR AREAS

A. Provide career mentoring for students, postdocs, research scientists, staff, and research faculty.
B. Provide social support to promote bonding and a Center culture that produces highly productive research and researchers.
C. Consider appointing an Associate Director to assist with Center leadership as Dr. Rittmann devotes more time to global dissemination and partnerships and to ensure long-term leadership continuity.

MEASURES OF SUCCESS

Success can be measured in many ways:

- Aspirations
- Awards
- Career Progression
- Center Feedback
- Collaborations
- Commercialization
- Courses (Developed, Delivered)
- Funding
- Graduates
- Infrastructure Strength
- Job Placements
- Outreach
- Patents
- Presentations
- Press Coverage
- Publications
- Recruiting
- Safety
- Scholar Diversity
- Service
- Space Utilization
- Spin-Outs

- Celebrations with Workmates
- Costume Contests
- Decorating Cubicles/Benches
- Donation Drives
- Goofy Faces
- Participation
- Smiles
- Social Support
- Time Spent with Labmates
- Time Spent on Projects
- TShirt Contests

PhD students Moni Miranda (Delgado Lab) and Ben Agbo (Torres Lab) exemplify how our team works hard, supports one another, and has fun together!

HIGHLIGHTS

Krajmalnik-Brown Lab Research Featured in Economist Radio Podcast

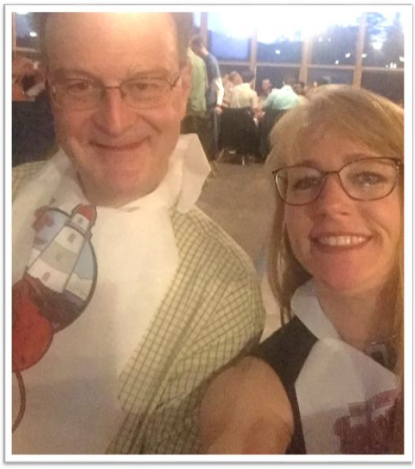
You can listen to a podcast by Economist Radio about the relationship between gut microbes and Autism Spectrum Disorder, which features work done in Dr. Rosa Krajmalnik-Brown's laboratory, HERE.

Here is a synopsis from their website: *How can understanding the link between gut bacteria and Autism Spectrum Disorder help scientists develop a treatment?*

Boyer wins Excellence in Service Award from the School of Sustainable Engineering and the Built Environment

Dr. Treavor Boyer is the 2019 recipient of the Excellence in Service Award from the School of Sustainable Engineering and the Built Environment (SSEBE). Dr. Boyer was recognized for his outstanding leadership as the chairman of the committee that planned and carried out the 2019 Biennial Conference of the Association of Environmental Engineering and Science Professors (AEESP), which was hosted by Arizona State University in May 2019. The 2019 conference was the largest and, most attendees agree, the best AEESP Conference ever. Dr. Boyer also is the director of SSEBE's Environmental Engineering Program, an associate professor in SSEBE, and a faculty member in the Biodesign Swette Center for Environmental Biotechnology.

Rittmann and Lewis attend the Gordon Research Conference on Photosynthesis



Bruce Rittmann presented at the Gordon Research Conference on Photosynthesis: From the Biophysics of Natural and Artificial Photosynthesis to Bioenergy Conversion in Newry, Main in July 2019. His talk was titled *Realizing the Benefits of Delivering a Source of Concentrated CO_2*.

Christine Lewis also attended and was one of five researchers selected to present her poster during a plenary session. She presented her PhD work entitled *Microbial Electrophotosynthesis*. She reports, "It is the first time I have presented in front of hundreds of experts in the field that deals

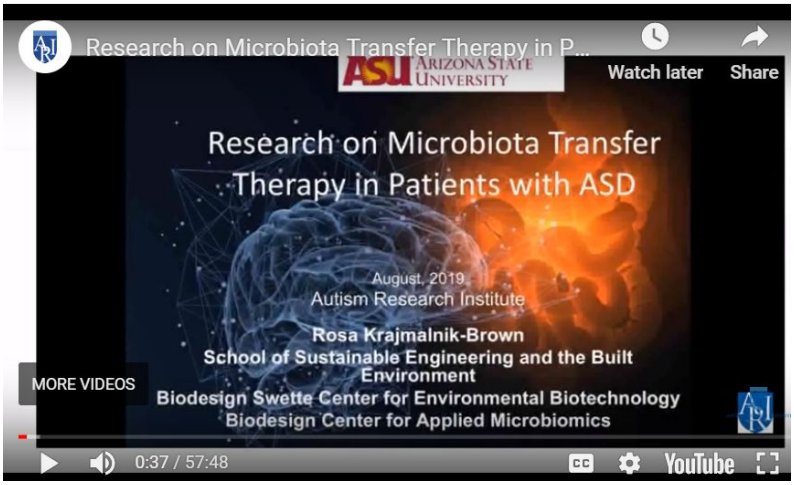
with photosynthesis and I had only one day to prepare the presentation. Perhaps, I was more apprehensive because my project is very different from most other types of projects. I gave a 15 minute presentation and it was a wonderful experience. The crowd was both interested in my project and also had some fantastic next-step ideas that can further our understanding about the fundamentals of photosynthesis."

The week culminated in a large celebration at the top of the mountain in Sunday River, Maine, where they provided live music and a feast with fresh Maine lobster. Christine said, "Bruce taught me how to properly eat a lobster. Although it was a bit messy, it was delicious."

Dr. Rosy Presents Autism Webinar for Autism Research Institute

Dr. Rosa Krajmalnik-Brown presented "Research on Microbiota Transfer Therapy in Patients with ASD" as part of an Autism Research Institute webinar on Wed, Aug 28, 2019 from 1:00 PM – 2:01 PM EDT .

HERE is the link.



The Biodesign Swette Center for Environmental Biotechnology is an award winning center for safety. With a great deal of participation by all Center members, we won two safety awards this semester; and at the center of it all is our Laboratory Coordinator, Sarah Arrowsmith.

1. **ASU Environmental Health & Safety Award for Excellence.** The award is the highest level of recognition by EHS and is presented to a college, department, individual or team who showcase distinguished service toward campus safety or sustainable practices at ASU. Any university employee may submit a nomination. Submissions must include a detailed statement outlining the nominee's outstanding performance in meeting at least one of the key criteria:
    - Incident response beyond the call of duty.
    - Leadership in safety or sustainability excellence.
    - Longevity of commitment to ASU safety or sustainability.

    Sarah Arrowsmith has developed an excellent culture of equipment maintenance and training. She assigns a researcher to maintain and train

newcomers, minimizing risks and possible equipment failures. She works with these designated researchers to ensure each instrument is maintained. She recently did an assessment of our waste generation in order to discuss possible ways to minimize it. This was an excellent discussion among researchers that led to new protocols to minimize waste.

Sarah established needles/sharps training in July of 2019. She helped to create a Canvas Onboarding course and the establishment of a safety contract and disseminates weekly/monthly safety notices in meetings and emails. Sarah involves students when filing for IBC's so that they know how risk assessments work. She delivered a risk assessment workshop during a Whole Center meeting in September of 2019.

2. **ASU Laboratory Safety Innovation Award.**

The ASU Laboratory Safety Committee, in partnership with Knowledge Enterprise and Environmental Health and Safety, called for applicants to enter the annual Laboratory Safety Innovation Award competition. The competition recognizes innovative implementation of a research safety program and acknowledges outstanding involvement of a principal investigator and support of senior administrators who demonstrate the shared commitment to the safe and responsible conduct of research in a laboratory setting. A laboratory is defined as a facility or room where the use of potentially hazardous chemicals, biological agents or sources of energy (e.g., lasers, high voltage, radiation) are used for scientific experimentation, research or education. The criteria for the award required an innovative safety plan that will be implemented in your program or process, including details on how this plan will be implemented and internally evaluated.

Needles and Sharps Training Program

Our innovation was a new Needles and Sharps Training Program. The objective was to create a Needles and Sharps Canvas Course to help track who has taken sharps training and in-person mentoring in the Center. This class should increase awareness about sharps and decrease incidents of needle sticks and injuries in our Center. The class can be exported for use in other labs who use needles.

Our Solution:

1. **Canvas Course Development**. This will include a short training video about how to safely handle needles and other sharps. This video will be a general overview to increase mindfulness. The canvas module will also include a short quiz to review what students have learned and reinforce the important take-home messages. The training course will be available to all of our lab members for internal use. This will be either a stand-alone course or a module within our current onboarding Canvas course.

2. **Development and Implementation of In-Person Training Standards.** The lab coordinator or research supervisor will provide in-person training to include the following:

- how to safely lock a needle and syringe in place;
- how to transport needles/syringes safely from bench samples to instruments;
- how to properly use our newly-invented needle guard (see below);
- how to safely remove needles from non-disposable syringes, including how to remove needles using the lip on red sharps bins;
- what to do when injuries do happen, including first aid and how to report an injury.

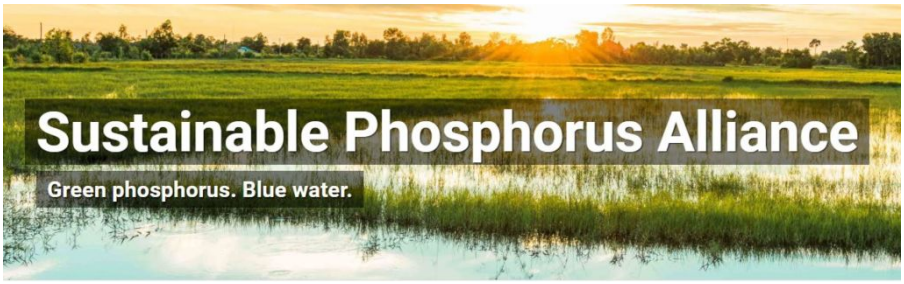
At a celebration on December 4, 2019, Dr. Krajmalnik-Brown and Sarah accepted the award on behalf of our Center and provided background for the project. Eventually, EH&S wants to make the program available throughout ASU. We are grateful for our team's ongoing support in this endeavor to keep our people safe!

Delgado Lab Members Attend Phoenix College STEAM Day

Delgado Lab PhD students Moni Miranda and Srivatsan Mohana Rangan demonstrated a miniature bioreactor at the Phoenix College STEAM day, 7th November 2019. They advertised the research opportunities within the Swette Center for Environmental Biotechnology and Research Experience for Undergraduates (REU) program at the Center for Bio-mediated and Bio-inspired Geotechnics (CBBG) to current and prospective Phoenix College students. The event was very successful and we received many inquiries from students after the event.

Research Needed in Food Waste Co-digestion

Swette Center Postdoctoral Researcher Michelle Young's blog *Research Needed in Food Waste Co-digestion* is featured on the Sustainable Phosphorus Alliance site. Here, she explains that 30-40% of the U.S. food supply ends up as food waste, 76% of which is sent to landfills and accounts for one-third of landfill greenhouse gas emissions. Dr. Young suggests eliminating emissions by adding food waste to wastewater during anaerobic treatment to harvest electric energy. Additionally, she sees potential that future research could exploit the energy produced during co-digestion to support concurrent phosphorus recovery.



https://phosphorusalliance.org/

DOD SERDP and ESTCP Highlight Rittmann Lab Project

Rittmann and colleagues have reported a novel biodegradation approach combining anaerobic biological removal of #TCA and #TCE and aerobic biological removal of 1,4-dioxane. The downloadable report and audio summary of **Synergistic Reductive Dechlorination of 1,1,1-Trichloroethane and Trichloroethene and Aerobic Biodegradation of 1,4-Dioxane** was highlighted by DOD-SERDP-ESTCP to drive viewers to the conference website for Environmental Research Program**s**. https://go.usa.gov/xV4BP.

They also highlighted the project on their social media channels.

- Twitter
- Facebook
- LinkedIn

SERDP DOD • EPA • DOE | ESTCP

DoD's Environmental Research Programs

PhD Student Daniella Saetta was selected as an MIT CEE Rising Star.

20 civil and environmental engineering postdocs and PhDs were selected to participate in this workshop which focused on the academic job search. We all presented our research and then discussed pathways into academia. It was really fun! (Danielle is front and center in the picture.) MORE HERE

Dr. Andrew Marcus Encouraged BSCEB Members to Find Their Superpower with Sebastian from Ultraworking

On February 9, 2019, Sebastian Marshall, a cofounder and the CEO of Ultraworking, offered a free session of Work Cycles to our Center members. Work Cycles was advertised as a method used by NASA and Google to boost one's productivity. While an individual is likely to falter on their own (the myth of a 'lone wolf'), Work Cycles invite people to work amongst peers and use social accountability to boost their morale.

> ***"The ability of people to define good work decays faster than their ability to execute it."***
>
> ***"After a few cycles of small consistent victories, I was gaining momentum, like a snowball."***

Dr. Marcus and several BSCEB members have taken advantage of this exceptional partnership with Ultraworking and adopted new methods of getting things done. Sebastian also has a podcast on working more effectively.

Dr. Rosy Receives Outstanding Alumni Award from Universidad Autónoma Metropolitana

Dr. Rosa Krajmalnik-Brown has been selected to join the list of outstanding alumni who hail from Universidad Autónoma Metropolitana. She was nominated by a former professor and was selected as winner of July of 2019.

Casa abierta al tiempo
UNIVERSIDAD AUTÓNOMA METROPOLITANA

Sudeep Popat receives $750K NASA grant

Torres Lab alumnus Sudeep Popat, Asst. Professor at Clemson University, received a $750,000 grant to study how astronaut waste can be transformed into hydrogen peroxide and energy during long-term space missions. Read an article in The State and view an interview on CountOn News2.

United Way Campaign 2019 - This year the Swette Center won the award for most participation in the United Way Campaign during Team Spirit Week, had four ambassadors to urge giving, had one winner of the Halloween Campaign Costume Kickoff, and donated a lot of food!


Sarah Arrowsmith


Neng long Chan


Carole Flores


Khemlal Nirmalkar

T-Shirt Contest - For the past several years, we have sponsored a T-shirt contest to celebrate our Center culture. Here is this year's winner, by Sarah Arrowsmith.

Celebrations

The Swette Center likes to celebrate together! We enjoyed a Halloween party, Holiday potluck and white elephant gift exchange, and monthly birthdays. The Krajmalnik-Brown and Torres labs also participated in a beginning-of-the-semester team-building scavenger hunt that was SO MUCH FUN!

The Biodesign Institute is a place unlike any other.

We assemble scientifically diverse teams to galvanize great ideas into real-world global solutions in state-of-the-art research laboratories at Arizona State University (one of the nation's largest public research universities) located in Tempe, Arizona. Whether it's seeking a cure for Ebola, removing toxic chemicals from air and water, or developing a diagnostic tool to assess widespread radiation exposure, the scientists at the Biodesign Institute take their cues from people and nature.

OUR APPROACH

We see things differently at Biodesign. Research begins with the identification of a real-world threat or opportunity and engages the best minds and resources.

- ***We illuminate threats*** … we identify and understand threats to our health, personal security and our planet
- ***We mobilize teams*** … our dynamic teams are interdisciplinary – involving biologists, chemists, engineers, statisticians, physicists, mathematicians, etc. – who look to nature for inspiration to solve today's grand challenges
- ***We shepherd solutions*** … we are committed to getting our research outcomes into the hands of those who need it most – through discoveries shared in publications, open science, products or spin-off companies.

OUR INSPIRATION

The ASU Biodesign Institute was not created in the image of a traditional research institute, with a rigid focus on a single field of study, but instead focuses on biological and nature-inspired solutions of public value. ASU is broadly inclusive in approach, advancing education for everyone.

THE BIODESIGN MODEL

Launched in 2003, the Biodesign Institute is organized into 16 research centers led by world-renowned scientific leaders and staffed by distinguished faculty, technicians and students from all over the world – all of whom are dedicated to providing real world solutions to today's global challenges.

OUR LEADERSHIP

Joshua LaBaer, MD, PhD

Executive Director, Biodesign Institute at ASU
Director, Biodesign Virginia G. Piper Center for Personalized Diagnostics, Professor, School of Molecular Sciences
Adjunct Professor of Medicine, College of Medicine, Mayo Clinic

ASU Biodesign Institute
Arizona State University

APPENDIX

For more information, visit the Center website: http://www.environmentalbiotechnology.org/

PUBLICATIONS

1. Adams JB, Vargason T, Kang DW, Krajmalnik-Brown R, and J Hahn (2019 Nov). Multivariate Analysis of Plasma Metabolites in Children with Autism Spectrum Disorder and Gastrointestinal Symptoms Before and After Microbiota Transfer Therapy. *Processes*, *7*(11), 806. https://doi.org/10.3390/pr7110806

2. Adams JB, Borody TJ, Kang DW, Khoruts A, Krajmalnik-Brown R, and MJ Sadowsky (2019 Nov 01). Microbiota transplant therapy and autism: lessons for the clinic. *Expert review of gastroenterology & hepatology*. Volume 13, 2019 - Issue 11, pages 1033-1037. https://doi.org/10.1080/17474124.2019.1687293

3. Allen, R., B. E. Rittmann, and R. Curtiss (2019). Axenic biofilm formation and aggregation by Synechocystis PCC 6803 induced by changes in nutrient concentration and requires cell surface structures. Appl. Environ. Microb. 85: e02-192-18.

4. Buessecker, S., Tylor, K., Nye, J., Holbert, K. E., Urquiza Muñoz, J. D., Glass, J. B., Hartnett, H. E., and Cadillo-Quiroz, H.: Effects of sterilization techniques on chemodenitrification and N2O production in tropical peat soil microcosms, Biogeosciences, 16, 4601–4612, https://doi.org/10.5194/bg-16-4601-2019, 2019.

5. Cahill, B., L. Straka, J. Maldanado, R. Krajmalnik-Brown, and B. E. Rittmann (2019). Effects of light intensity on soluble microbial products produced by Synechocystis sp. PCC 6803 and associated heterotrophic communities. Algal Research 38: xxx-yyy (DOI: doi.org.10.1016/j.algal.2019.101409.

6. Chan, N.I., Heiling, M., and Adu-Gyamfi, J. (2019). Phosphate oxygen isotopes in soil P fractions in Chernozem and Cambisol from Lower Austria. Poster presentation at 2018-2019 International Soils Meeting, January 6-9, 2019, San Diego, CA.

7. Chen T, Yavuz BM, Delgado AG, Januszewski B, Zuo Y, Westerhoff P, Krajmalnik-Brown R, Rittmann BE (2019 Aug 16). Multicycle Ozonation+ Bioremediation for Soils Containing Residual Petroleum. *Environmental Engineering Science*. https://doi.org/10.1089/ees.2019.0195

8. Gruber, R., Chan, N.I., Heiling, M., Adu-Gyamfi, J., Heng, L. and Dercon, G. (2019). Oxygen isotopes in phosphate to study soil P fractions and to trace sources of pollutants

in agricultural catchment. 2019, April. Poster presentation at European Geosciences Union annual conference, Vienna, Austria.

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Membrane Biofilm Reactor. Frontiers in Microbiology 9: article 3268 (doi: 10.3389/fmicb.2018.03268.

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40. Zhou, Y., Y.-J. Lai, E. Eustance, and B. E. Rittmann (2019). Promoting Synechocystis sp PCC 6803 harvesting by cationic surfactants: alkyl-chain length and dose control the release of extracellular polymeric substances and biomass aggregation. ACS Sustainable Chemistry & Engineering 7: 2127-2133.

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POSTERS & PRESENTATIONS

1. Aerts J, Hut R, Drost N, van Werkhoven, van Haren R, Dzigan Y, Camphuijsen J, Alidoost F, Pelupessy I, Weel B, van den Oord G, Verhoeven S, Bouaziz L, van Verseveld W, Jagers B, Baart F, Sutanudjaja E, Hoch J, Melsen L, Bennett A, Arnal L, Fenicia F, Santos L, Gelati E, Molin M, Knoben W, Gharari S, Hall C, Hutton E, Van De Giesen N. (2019 December 13) ERA-Interim vs ERA-5 Hydrology Comparison. American Geophysical Union, San Francisco, CA.

2. Cadillo-Quiroz H and D Finn (2019 Dec 13). Primary Fermenter And Hydrogen-Consuming Microbial Keystone Taxa Are Associated With Carbon Use Efficiency In Tropical Peatlands Of Peruvian Amazonia. American Geophysical Union Fall Meeting, San Francisco, CA.

3. Davis T, Hall C, Rittmann B (2109 May 18). Modeling In-Situ Permeable Reactive Barriers (PRBs) for Subsurface Acid Mine Drainage (AMD) Remediation. AEESP, Tempe, AZ.

4. Drost N, Hut R, Van De Giesen N, van Werkhoven B, Aerts J, Pelupessy I, Weel B, Verhoeven S, van Haren R, Hutton E, van Meersbergen M, Alidoost F, van den Oord G, Dzigan Y, Camphuijsen J, Andela B, Hall C. The eWaterCycle platform for Open Science Hydrology. American Geophysical Union, San Francisco, CA.

5. Edgar M, and Treavor Boyer (2020 Jan 9). Biological Ion Exchange for the Removal of Natural organic Matter from Surface Waters. AZ Water, Phoenix AZ.

6. Glaser D, Finn D, Cadillo-Quiroz H, Perez-Montano S, Desch SJ, and HE Hartnett (2019 Dec 9). Microenvironments of Habitability in the Hyperarid Atacama Desert. American Geophysical Union Fall Meeting, San Francisco, CA.

7. Hall CA, Rittmann BE, Kavazanjian E, and LA van Paassen (2019 Dec 1). Multiphase Biogeochemical Model to Predict Microbially Induced Desaturation and Precipitation for Earthquake Hazard Mitigation. American Geophysical Union Fall Meeting, San Francisco, CA.

8. Hall C (2019 November 1). Communicating Science to Decision-makers Using Briefs and Opinion Editorials. Tampa, Florida.*

9. Hall C (2019 December 2). Communicating Science to International Decision-makers Using Briefs and Opinion Editorials. Delft, Netherlands.*

10. Hall C (2019 December 2). Early Career Scientists in Science Policy. Delft, Netherlands.*

11. Hall C and van Emmerik T (2019 December 9). Rhyme Your Research: Science Through Poetry. American Geophysical Union, San Francisco, CA.*

12. Hall C, Guimond J, van Emmerik T, and Illingworth S (2019 December 8). Building Momentum: Developing Sustainable Cross-Disciplinary Collaborations. American Geophysical Union, San Francisco, CA.

13. Hall C, Arveson S, Barickman M, Brugman K, Creasy N, Martin P, McIntosh Marcek H, Rao Y, Oakes R, and van Emmerik T. (2019 December 11). Early Career Scientist Forum. American Geophysical Union, San Francisco, CA.

14. Hall C, Drost N, Hut R, Van De Giesen N, van Werkhoven B, Aerts J, Pelupessy I, Weel B, Verhoeven S, van Haren R, Hutton E, van Meersbergen M, Alidoost F, van den Oord G, Dzigan Y, Camphuijsen J, Andela B. eWaterCycle: Putting the Public in Charge is Only FAIR. American Geophysical Union, San Francisco, CA.

15. Lewis, Christine (2019). Nature (Journal) Energy Award for the best poster probing energy or charge transfer. AWARDED TO: Christine Lewis, ASU Biodesign Institute, for “Unlocking Efficiency: Dynamic electro-molecular investigations of photosynthetic energy flow.”

16. Lewis, Christine (Oct 2019). LAD (legislative Action Days) in Washington D.C. (the Hill) for higher ed legislation for graduate students. Presented and met with staff of Kirsten Sinema, Martha McSally and Rudy Gallego

17. Lewis, Christine (Nov 2019). Nature Conference Functional Dynamics: molecules in motion @ ASU, presented a lightning talk on project.

18. Levi J, Guo S, Kavadiya S, Yin Y, Atkinson AJ, Holman Z, Rittmann BE (2019 Nov 11). Nitrate Reduction By Catalytic Hydrogenation: Controlling Hydrogen Delivery with

Nano-Enabled Polymeric Hollow Fibers. 2019 American Institute of Chemical Engineers Annual Meeting, Orlando, FL.

19. Long and Westerhoff (2019 November). The nature and reactivity of urban magnetic pollution nanoparticles: new insights into associated neurotoxicity mechanisms. Sustainable Nanotechnology Organization, San Diego, CA

20. Mohana Rangan S, Ibrahim I, Delgado AG, Krajmalnik-Brown R. (May 2019) Development of Microbial Enrichment Cultures for Detoxification and Immobilization of Toxic Cr (VI). AEESP Research and Education Conference, Tempe, AZ.

21. Mangus, A (2019 November 15). Culturing Conditions of Synechocystis sp. PCC6803 Mutant for Microbial Electro-Photosynthesis. FURI Fall 2019 Symposium, Tempe, AZ.

22. Miranda E, Severson C, Reep K, Hansen S, Santisteban L, Kavazanjian E, Hamdan N, Delgado A (October 2019) Sustained Heavy metal removal from acid mine drainage in pilot-scale sulfate-reducing bioreactors with sugarcane bagasse and spent brewing grains. 4th Annual Meeting for Center for Bio-mediated & Bio-inspired Geotechnics, Tempe, Arizona.

23. Mohana Rangan S, Delgado AG, Krajmalnik-Brown R (February 2019). Rapid Reduction of Hexavalent Chromium by Microbial Culture Enriched from Contaminated Soil. 9th Annual SSEBE Graduate Research Symposium, Tempe, AZ.

24. Richard R. et al. (2019 Nov 04). Water Quality and Occupancy Sensing Shows Statistically Different Trends by Floor in LEED Platinum Building. 2019 Water Quality Technology Conference, Dallas, TX*

25. Rittmann BE (2019 July 2). Optimizing Microalgae Production by Delivering Sources of Concentrated CO2. IWA Microalgae Conference, Valladolid, Spain.

26. Rittmann BE (2019 July 23). Optimizing Microalgae Production by Delivering Sources of Concentrated CO2. Gordon Research Conference on Photosynthesis, Newry, ME

27. Rittmann BE (2019 Oct 25). From Treatment to Resource. Well Spring Conference, Tacoma, WA

28. Rittmann BE (2019 October 30). Ironies of Microbial Electrochemistry. Annual Conference of the Chinese Society for Microbial Ecology, Changsha, China..

29. Rittmann BE (2019 November 4). Prying Open the Black Box. Sixth International Conference on Environmental Simulation and Pollution Control, State Key Laboratory on Water Quality, Tsinghua University, Beijing, China.

30. Rittmann BE (2019 November 4).More is Less. Sixth International Conference on Environmental Simulation sna Pollution Control, State Key Laboratory on Water Quality, Tsinghua University, Beijing, China

31. Rittmann BE (2019 November 6). Biofilm Processes. Tongji University, Shanghai, China.

32. Rittmann BE (2019 November 8). Ironies of Microbial Ecology. Tongji University, Shanghai, Chin

49. Saetta D (2019 October 24-25). Urine diversion: Radical change, incremental steps. MIT CEE Rising Stars. Cambridge, MA.*

50. Scholz M, Daniel T, Biedenfeld M, and M Buchanan (2019 08 15). Upcycling Phosphorus for Agricultural Use. Sustainable Phosphorus Webinar Series (online). *

51. Scholz M, Elser J, Haygarth P, Jarvie H, and R Marshall (2019 11 20). Phosphorus Turns 350! Sustainable Phosphorus Webinar Series (online). *

52. Scholz M and D Scavia (2019 12 09). Anatomy of a Binational Watershed. Phosphorus Science Now! (online) *

53. Scholz M and J-O Goyette (2019 09 30). Watershed Buffering Capacity for Phosphorus. Phosphorus Science Now! (online) *

54. Scholz M (2019 10 01). Phosphorus Sustainability Challenge. US EPA AgSTAR Partner call.*

CONFERENCE / WORKSHOP PARTICIPATION

1. Flores, C. Grants Research and Sponsored Projects GRASP 2019 Conference (2019 Dec 10), Knowledge Enterprise, Arizona State University, Tempe, AZ
2. Zheng, C (2019 May 14). Association of Environmental Engineering and Science Professors, Arizona State University, Tempe, AZ
3. Altizer, M (2019 Aug 5-6). (Clean Water Workshop, Oregon State University, Corvallis, OR.
4. Rittmann, B (2019 Dec 3-5). SERDP/ESTCP Conference, Washington, DC.
5. Crane, L (2019 May 14-16). Association of Environmental Engineering & Science Professors, Arizona State University, Tempe, Arizona.
6. Agbo, B (2019 Oct 29-30). NSF Site Visit Year 4 Renewal Review, Arizona State University Tempe, Arizona
7. Howley, E (2019) Biofilm Workshop, Notre Dame University, South Bend, Illinois
8. Scholz, M (2019 Nov 13). SERA17, San Antonio, TX

9. Hall, C (2019 Oct 18-20). Science Communication Conference, University of Colorado, Boulder, Boulder, CO.
10. Hall, C (2019 Nov 1). Society of Hispanic Professional Engineers, Phoenix, AZ.
11. Eustance, E. 2019 Algae Biomass Summit (2019 September 16-19), ABO, Orlando, FL.
12. Dietz, R (2019). SERDP & ESTCP 2019 Conference/SERDP & ESTCP
13. Dietz, R (2019). AWWA Water Quality Technology Conference 2019
14. Lewis, C (2019 Sep). Developing the Commercial Spaceflight Research Marketplace: Challenges, Solutions and Benefits @ ASU.

PATENTS

1. Adams J, Krajmalnik-Brown R, Kang DW, Sadowsky MJ, Khoruts A (2019 Dec 03). Methods for treating autism spectrum disorder and associated symptoms. US Patent App. 16/510,506.

2. Delgado AG, Robles A. The use of microbial chain elongation for treatment of oxidized contaminants. Tech ID M20-034L, submitted 07/29/2019.

3. Eustance E, Rittmann BE, Lai YS, Shesh T, Flory J. 2019. Method and System for Membrane Carbonation (M19-138L)

4. Flory J, Fromme P, Vermaas W, Rittman BE, Torres CI, Moore T, and A Moore (2019 Aug 20). Microbial electro-photosynthesis. US Patent 10,385,304.

5. Parameswaran P, Krajmalnik-Brown R, Popat S, Rittmann BE, and C Torres (2019 Oct 08). Membrane biofilm reactors, systems, and methods for producing organic products. US Patent 10,435,659.

FUNDED RESEARCH

ASU Award and Title	Award/Grant PI	Sponsor	Start	End	Budget
AWD00033536: CBBG Core Project: Freeport McMoRan	Anca Delgado	ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	9/1/2018	5/31/2020	$82,787.00
AWD00034089: Natural organic components in soils interfering wi	Anca Delgado	Chevron Energy and Technology Company	8/12/2019	12/31/2021	$72,642.00
AWD00033324: Food Waste Digestion for Mesa, Arizona	Bruce Rittmann Michelle Young	City of Mesa	10/1/2018	12/31/2019	$113,775.00
AWD00033471: Co-digestion of Food Waste and Fats, Oils, and Gre	Bruce Rittmann Michelle Young	City of Tempe	10/1/2018	12/31/2019	$76,013.00

AWD00033918: NEWT Non-Core Project - Reductive Defluorination a	Bruce Rittmann Chen Zhou	Xylem, Inc.	4/1/2019	3/31/2020	$121,058.00
AWD00030280: SusChEM: COLLABORATIVE RESEARCH: Engineering the	Bruce Rittmann	National Science Foundation (NSF)	7/1/2016	6/30/2020	$209,022.00
AWD00034186: Biodegradation of 1,4-Dioxane Using Ethane as the	Bruce Rittmann Chen Zhou	US Department of Defense (DOD)	8/15/2019	8/14/2020	$182,900.00
AWD00033582: Membrane Carbonation for 100% Efficient Delivery o	Bruce Rittmann	DOE: Office of Energy Efficiency and Renewable Energy (EERE)	10/1/2018	9/30/2020	$1,992,766.00
AWD00033582: Membrane Carbonation for 100% Efficient Delivery (Cost Share)	Bruce Rittmann	DOE: Office of Energy Efficiency and Renewable Energy (EERE)	10/1/2018	9/30/2020	$127,306.00
AWD00031653: Enhancing Biodegradation of Quaternary Ammonium Co	Bruce Rittmann Yen-Jung Lai	National Science Foundation (NSF)	7/1/2017	6/30/2021	$379,738.00
AWD00034674: Enabling 3D Fluorescence Imaging Under Anaerobic E	Cesar Torres	DOD-NAVY: Office of Naval Research (ONR)	6/1/2019	5/31/2020	$182,326.00
AWD00033795: Generating electrical power from blackwater using	Cesar Torres	DOD-NAVY: Office of Naval Research (ONR)	2/18/2019	2/28/2021	$112,323.00
AWD00029108: Engineering Research Center for Bio-Mediated and B	Edward Kavazanjian; Hinsby Cadillo	National Science Foundation (NSF)	8/1/2015	7/31/2020	$183,326.00
AWD00029108: Engineering Research Center for Bio-Mediated and B	Edward Kavazanjian; Anca Delgado	National Science Foundation (NSF)	8/1/2015	7/31/2020	$172,602.00
AWD00029108: Engineering Research Center for Bio-Mediated and B	Edward Kavazanjian; Rosa Krajmalnik-Brown	National Science Foundation (NSF)	8/1/2015	7/31/2020	$434,161.00
AWD00029108: Engineering Research Center for Bio-Mediated and B	Edward Kavazanjian; Cesar Torres	National Science Foundation (NSF)	8/1/2015	7/31/2020	$363,658.00

AWD00029108: Engineering Research Center for Bio-Mediated and B	Edward Kavazanjian; Cesar Torres	National Science Foundation (NSF)	7/1/2018	7/31/2020	$157,445.00
AWD00029108: Engineering Research Center for Bio-Mediated and B	Edward Kavazanjian; Cesar Torres	National Science Foundation (NSF)	8/1/2015	7/31/2020	$80,763.00
AWD00034512: Monitoring the changes in methane (CH4) emissions	Hinsby Cadillo-Quiroz	ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	8/1/2019	7/31/2020	$157,583.00
AWD00034493: Biophysical processes and feedback mechanisms cont	Hinsby Cadillo-Quiroz	University of Minnesota	9/1/2019	8/31/2020	$47,450.00
AWD00033032: CAREER: Geochemical and functional controls of met	Hinsby Cadillo-Quiroz	National Science Foundation (NSF)	12/1/2018	11/30/2023	$601,213.00
AWD00033032: CAREER: Geochemical and functional controls of met	Hinsby Cadillo-Quiroz	National Science Foundation (NSF)	12/1/2018	11/30/2023	$48,800.00
AWD00033027: Mathematical and Process Model for Biological Tran	Joshua Boltz	Electric Power Research Institute	7/16/2018	6/30/2020	$298,033.00
AWD00034415: A model of nitrous oxide production in biological	Joshua Boltz	Brown and Caldwell	10/7/2019	7/31/2020	$25,000.00
AWD00030736: Integrating Quantitative Energetics Determines the	Rosa Krajmalnik-Brown	HHS: National Institutes of Health (NIH)	9/1/2016	6/30/2020	$1,433,354.00
AWD00032554: Enhanced Statistical Analysis of Phase 1 FMT Trial	Rosa Krajmalnik-Brown	Finch Therapeutics Group	10/1/2018	9/30/2020	$129,404.00
AWD00030931: CAREER: Sustainable Urine Processes through integr	Treavor Boyer	National Science Foundation (NSF)	7/15/2016	12/31/2019	$52,352.00
AWD00030931: CAREER: Sustainable Urine Processes through integr	Treavor Boyer	National Science Foundation (NSF)	7/15/2016	12/31/2019	$104,275.00

AWD00033797: Workshop: Support for 2019 AEESP Research and Educ	Treavor Boyer	National Science Foundation (NSF)	4/1/2019	3/31/2020	$45,597.00
AWD00033797: Workshop: Support for 2019 AEESP Research and Educ	Treavor Boyer	National Science Foundation (NSF)	4/1/2019	3/31/2020	$4,400.00
AWD00032090: Core Project: Development of a Reactive Geocomposi	Treavor Boyer	ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CGGB) Consortium	8/18/2017	7/31/2020	$214,067.00
AWD00033532: REGENERABLE RESIN SORBENT TECHNOLOGIES WITH REGENE	Treavor Boyer	Colorado School of Mines	9/6/2018	9/5/2020	$130,430.00
ASU-BGU Aquatic Plant Nutrition PG10668	Rosa Krajmalnik-Brown	ASU-BGU Partnership	7/1/2019	6/30/2020	$15,000
G07577 Autism Research	Rosa Krajmalnik-Brown	ASU Foundation	7/1/2019	6/30/2020	166,389
PG12871 Improving Lignocellulose Degradation for Energy and Chemical Production Using Microbial Enrichment	Bruce Rittmann Michelle Young	Lightworks Sustainable Fuels and Products Challenge	7/1/2019	6/30/2020	$25,000
PG12910 Bioprocess Development to Increase Carbon Utilization in Biofuel Fermentations	Bruce Rittmann	Lightworks	7/1/2019	6/30/2020	$25,000
PG07719 Synergistic Coupling of Solar Thermochemistry with Microbiology to Close the Carbon Cycle	Bruce Rittmann	Lightworks Sustainable Fuels and Products Challenge	7/1/2019	6/30/2020	$35,000
PG12199 A Model-Based Engineering Evaluation of the Anaerobic Biofilm Membrane Bioreactor (AnBfMBR) and Ion Exchange (IX) for Achieving ASU's Treatment and Sustainability Criteria	Bruce Rittmann Josh Boltz Michelle Young	ASU Facilities	7/1/2019	6/30/2020	$5,000
Regents' Professor	Bruce Rittmann	ASU Board of Regents	7/1/2019	6/30/2020	$10,000
PLuS Alliance	Bruce Rittmann	ASU Provost			$10,000

All professors have access to supplies funds available through the Fulton Undergraduate Research Initiative (FURI) and Master's Opportunity for Research in Engineering (MORE) programs if they take on participating students. All PIs frequently host FURI students and Dr. Delgado is the most frequent MORE program mentor.

SPIN OUT COMPANIES

Precient Technologies, LLC (Tempe, AZ) -- Bruce Rittmann, Chen Zhou, Brad Lusk, and Lance Thompson. To commercialize the MBfR for removal and recovery of elements from waste streams.

Microbiome Engineering, LLC (Corvallis, OR) - - Megan Altizer, Timothy M. Vogel, Maude David. To commercialize microbial biosensors to monitor water quality in storm, surface, and waste water systems.

MENTORING

Mentor	**Protege(s)** (UG = undergraduate, G = graduate, HS = high school, VS = visiting scholar)
Megan Altizer	Kaitlyn Alvarez UG, Renfei Zheng G
Taylor Davis	Alana Florea UG
Blake Dirks	Randy Bravo UG, Debbie Chang UG
Everett Eustance	Tarun Shesh G
Steven Hart	Kaitlyn Alvarez UG, Anna Guerrero G
Khemlal Nirmalkar	Jigar Patel UG
Rick Kupferer	Austin Baker UG, Veronica Ayala Bojorquez UG, Abigail Johnson UG, Riley Tesman UG, Sam Utley UG
Yen-Jung (Sean) Lai	Tarun Shesh G
Christin Lewis	Aaron Bozukluoglu UG, Huong Dang UG, Jennifer Lewis G, Anna Mangus UG
Yuanzhe Liu	Neil Rastogi UG
Yihao Luo	Xiangxing Long G
Evelyn Miranda	Kyle Reep UG, Carli Severson UG
Sri Mohana Rangan	Xan McMacken UG
Hannah Ray	Angela Egan UG

Rain Richard	Lucas Crane UG, Rebecca Dietz G
Analissa Sarno	Elias Rodriguez UG
Thiago Stangherlin	Gamze Dogdu VS
Michelle Young	Austin Baker UG, Veronica Ayala Bojorquez UG, Rick Kupferer G, Riley Tesman UG, Sam Utley UG

TECH TRANSFER OUTPUTS

Future H_2O Engineering Associate and Boyer Lab member Carlos Leyva created an online dashboard for Biodesign C domestic water quality sensors.

https://io.adafruit.com/cfleyva/dashboards/bdc-floor-1
https://io.adafruit.com/cfleyva/dashboards/bdc-floor-2
https://io.adafruit.com/cfleyva/dashboards/bdc-floor-3
https://io.adafruit.com/cfleyva/dashboards/bdc-floor-4
https://io.adafruit.com/cfleyva/dashboards/bdc-floor-5

Technoeconomist Robert Stirling produce the following Techno-Economic Analysis Reports: Membrane Carbonation (Rittmann); Techno-Economic Analysis Report - ARPA-E Direct Air Capture (Green); Techno-Economic Analysis Internal Effort, Syngas to Value-Added Fuels and Chemicals (Rittmann); Techno-Economic Paper Manuscript drafted - Electrochemical Advanced Oxidation Processes (Westerhoff)

POPULAR PRESS COVERAGE

Hall, C (2019 Nov 8). "Science as Type II Fun" Blog Entry, https://blogs.egu.eu/divisions/hs/2019/11/08/science-as-type-ii-fun/

Rittmann, BE. I did a webinar for Noblis, Inc. On November 13, title: Synergistic removal of TCE, TCA, and 1,4-Dioxane in Membrane Film Reactors

Scholz, M (Interviewed by Grist (publication pending)

Pavia, M (2019, Fall). Season 2 of Mikroscope has aired!

WORKSHOPS (HOSTED)

1. Arrowsmith, A (2019 Sep). Risk Assessment Workshop, Arizona State University, Tempe, AZ. To teach how to systematically identify and control hazards to reduce risk of injuries and incidents prior to conducting an experiment for the first time.

2. Hall, C (2019 December 8). American Geophysical Union Student and Early Career Scientist Conference. American Geophysical Union, San Francisco, CA. To provide professional development and networking opportunities for students and early career scientists in the earth and planetary sciences.

3. Hall, C (2019 September 19). Arizona Science Policy Network Science Cafe Series. Tempe, AZ. Discuss mining and groundwater quality with scientists, decision-makers, and the public.

4. Hall, C (2019 September 19). Arizona Science Policy Network Science Cafe Series. Tucson, AZ. Discuss mining and groundwater quality with scientists, decision-makers, and the public.

5. Scholz, M (2019 11 14-15). Phosphorus Field-to-Watershed Modeling Workshop, San Antonio, TX. Convened USDA, academic, and industry researchers developing research on themes related to phosphorus transport through agricultural watersheds.

Matt Scholz et al, Phosphorus Field-to-Watershed Modeling Workshop

SUMMER PROGRAMS/INTERNSHIP PARTICIPATION

Mohana Rangan, S (2019 Summer). Hosted: Research Experience for Undergraduates (REU), Center for Bio-mediated and Bio-inspired Geotechnics (CBBG), Colleen E Bronner, cebronner@ucdavis.edu, May-July, 2019.

GRADUATES

Ayala-Bojorquez, Veronica (2019 Dec). BS Biological Sciences, School of Life Sciences

Chang, Debbie (2019 Dec). B.S. Molecular Biosciences and Biotechnology, Undergraduate, School of Life Sciences, Thesis: Eating Green, Examining the Effects of Mankai duckweed (Wolffia globosa) on Human Gut Microbial Community Structure and Function..

Liu, Yuanzhe (2019, Nov) Ph.D. Environmental Engineering, School of Sustainable Engineering and the Built Environment, Fulton Schools of Engineering. Understanding Electro-Selective Fermentation of Scenedesmus acutus and Its Effect on Lipids Extraction and Biohydrogenation.

Long, Min (2019 Sep 30). Ph.D., Tongji University, Study on Membrane Biofilm Reactor（MBfR) for Removing Chromate (Cr) and chlorophenols in water.

Rodriguez, Elias (2019 Dec). B.S. Microbiology, School of Life Science, Spring 2019

Taskan, Ergin (2019). Master degree (M.S), Department of Environmental Engineering, Firat University,Electricity Generation With Biophotovoltaic Cell.

Utley, Samuel (2019 Dec). BSE, Environmental Engineering, SSEBE

Zheng, C (2019 Dec). M.S., Environmental Engineering, Arizona State University, Treating Energetics-contaminated wastewater.

Zheng, Renfei (2019 Dec). M.S.E, Environmental Engineering, Ira A. Fulton Schools of Engineering.

JOB PLACEMENTS

Liu, Yuanzhe (2020 Feb 01). Alameda County Water District, Internship.

Rao, Shefali (2019 July). Junior environmental Engineer, Arcadis.

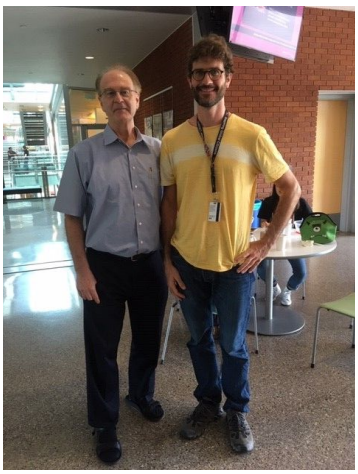
VISITING SCHOLARS

Yuhang Cai, PhD. Harbin Engineering University, China Scholarship Council, Rittmann Lab, 10/04/2019 - 3/31/2021.

Huai Li, Ph.D., Associate Professor, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, NO_x Bioreduction and Microbial Communities using C_2H_6 as Sole Electron Donor in a Membrane Biofilm Reactor, Rittmann and Zhou Labs, 10/10/2018 - 10/9/2019.

Ye Ji, doctoral candidate, Harbin Institute of Technology, Modeling on Food waste co-digestion with residue sludge, Michelle Young and Bruce E. Rittmann, 10/2019-10/2020

Dr Gamze Doğdu Okçu, Bolu Abant Izzet Baysal University, Turkey, Faculty of Engineering, Department of Environmental Engineering, Everett Eustance and Yen-Jung Lai were my mentors. Increasing Microalgae Productivity-"The Effects of Nitrogen Limitation on Biomass Productivity and Lipid Accumulation in Microalgae";"Membrane Carbonation for Dual Diatom and Coccolithophore Cultures"



Elie Le-Quéméner, Research Scientist, Institut national de la recherche agronomique, Narbonne, France, Using Linear Programming to Analyze Gut Fermenters.

Jundi Wang, PhD Student, School of Human Settlements and Civil Engineering, Jiaotong University, Xi'an, People's Republic of China, Combined chemical and microbiological approaches that enhance the remediation of the heavy fraction of petroleum hydrocarbons in contaminated soils.

COURSES DEVELOPED

Flores, C and S Arrowsmith (2019 Fall). *TRN-SwetteOnboarding*, Canvas. This online course provides new Center members instructions and resources pertaining to Center, Biodesign Institute, and Knowledge Enterprise administrative and laboratory processes.

Stangherlin-Barbosa, T (2019 Fall). Teaching Assistant Class Introduction for Environmental Engineering CEE 361: Teaching the Environmental Engineering Laboratory: Coagulation and Flocculation using the Jar Test teaching measurements: pH, alkalinity, turbidity. BOD5 for domestic wastewater. Hardness removal using lime and soda ash in the Jar testing; Air quality data collection and analysis for the Phoenix area. Preparing Students Homework and Exam questions. Grading Lab Reports and Exams. Designing Lab Protocols.

COLLABORATORS

Taylor Davis

Steven Smith, MD, TRI, Gut Microbiome Project, 6/1/2017-present

Carole Flores

Marcia Spurlock, Asst Director of Biodesign Research Operations, ASU Knowledge Enterprise Financial Services, 2019.

Ryan Given, Sr. Director of Biodesign Research Operations, ASU Knowledge Enterprise Financial Services, 2019.

Stephen Saunders, Business Analyst Sr, RTO Business Intelligence, 2019.

Christine Lewis

A MIT graduate student, Joseph Sands, collaborated and wrapped up his PhD at the end of November 2019 --working with our MEPS photosynthetic system for testing a new fabrication of fiber optics. He is still collaborating and preparing new brighter lights for the system. We have worked with him since Jan 2019-and he came as a visiting scholar at the onset of summer 2019 for two weeks.

Andrew Marcus

Elie Le-Quéméner, Research Scientist, INRA France, Using Linear Programming to Analyze the Gut Fermenters

Evelyn Miranda

Shane Hansen, Freeport McMoRan, Coupled treatment of acid mine drainage, August 2018 - Present

Leonard Santisteban, Freeport McMoRan, Coupled treatment of acid mine drainage. August 2018 - Present

Srivatsan Mohana Rangan

Gregory V Lowry, Walter J. Blenko, Sr. Professor, Carnegie Mellon University, Phoenix groundwater remediation project, Aug 2016 - May 2019.

Laurie LaPat-Polasko, Vice President/National Director of Remediation, Matrix New World Engineering, groundwater remediation project, Aug 2016 - May 2019.

Rain Richard

PepsiCo sensor project

Analissa Sarno

Dr. Egbert Schwartz, Professor and Director of Lab for Isotope, Molecular and Ecosystem Science, Northern Arizona University, DNA-Stable Isotope Probing of Northern Peatlands Using Glucose and Propionate, Fall 2019-Spring 2020

Matt Scholz

Dr. James Elser, Professor, ASU and U Montana, Sustainable Phosphorus Alliance, 07-present 2019; Dr. Rebecca Muenich, ASU, Sustainable Phosphorus Alliance, 07-present 2019; Dr. Carl Bolster, USDA-ARS, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Celine Vaneeckhaute, Universite Laval, Phosphorus Transport Modeling Group, 07-present 2019; Dr. David Vaccari, Stevens Institute, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Josh McGrath, University of Kentucky, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Margaret Kalcic, Ohio State University, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Rem Confessor, Heidelberg University, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Vinayak Shedekar, Ohio State University, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Pete Vadas, USDA-ARS, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Chad Penn, Purdue University, Phosphorus Transport Modeling Group, 07-present 2019; Dr. Laura Johnson, Heidelberg University, Phosphorus Transport Modeling Group, 11-present 2019; Dr. Hasan Tber, OCP SA, Phosphorus Transport Modeling Group, 11-present 2019; Dr. Fassil Kebede, UM6P, Phosphorus Transport Modeling Group, 11-present 2019; Dr. Mohammed El Gharous, UM6P, Phosphorus Transport Modeling Group, 11-present 2019; Dr. Jean-Michel Ghirdaglia, UM6P, Phosphorus Transport Modeling Group, 11-present 2019; Lucas Stephens, Environmental Law and Policy Center, Animal Feeding Operation Mapping Project, 07-present; Dr. Daniel Ho, Stanford University, Animal Feeding Operation Mapping Project, 07-present; Dr. Jessica Saunders, Stanford University, Animal Feeding Operation Mapping Project, 07-present; Dr. Colleen Long, Michigan State University, Animal Feeding Operation Mapping Project, 07-present; Dr. Danica Shaffer-Smith, The Nature Conservancy, Animal Feeding Operation Mapping Project, 07-present.

OUTREACH EVENTS

Arrowsmith, Sarah. United Way, ASU, Ambassador, October 2019

Chan, Neng Iong. Science and Faith, Pui Ching Middle School, Macau, China. Lecturer, 2019 May.

Crane, Lucas. SEE@ASU, Ira A. Fulton Schools of Engineering at Arizona State University, Instructor of Environmental Engineering, 2019 July 11.

Dietz, Rebecca. SEEASU Event, Ira A. Fulton Schools of Engineering at Arizona State University, Instructor of Environmental Engineering, 2019 July 11

Dietz, Rebecca. Living Word Chapel Short-Term Mexico Mission, Becky and Brent Strand, Helper, 2019 October 4-7

Flores, Carole.

United Way, ASU, Ambassador, October 2019

Lewis, Chrstine. Zoom in on science outreach I developed for 1-3 graders at Villa Montessori. The program was tested out in the spring of 2019 with 1 class, and its popularity grew into 6 classes participating in Fall 2019 and continues today.

Miranda, Evelyn. Steam Day, Phoenix College, Recruiter, November 2019.

Mohana Rangan, Srivatsan.

Exhibited a miniature of continuous flow through bioreactors and advertised research internship opportunities for current and prospective students of Phoenix College, STEAM Day, November 2019.

Demonstrated microscope operation for 7th to 12th graders at the RECHARGE conference, Arizona State University - West campus, February 2019.

Educated the public on capabilities of bioremediation using demonstrations at ASU open door event, Biodesign Institute, February 2019.

Rittmann, Bruce.

October 10 – “Waste to Benefit” Panel. Identifying Emerging Opportunities of Arizona Agriculture, USDA Sponsored Conference, Mesa Community College.

Other Presentations

September 17 – “Writing Scientific Papers and Getting Published,” ASU Post-doc Organization, Graduate College, ASU.

October 2 – “Environmental Biotechnology,” BDE 595, Prof. Halden, ASU

November 12 – “Opportunities in Microbial Bioenergy,” FSE 150, Grand Challenges class, Prof. Haolin Zhu, ASU.

November 19 – “Making Research Meet Practice in Environmental Biotechnology,” Center for Infection Virology and Vaccines, Biodesign Institute.

Stangherlin-Barbosa, Thiago. Event: Phoenix Fan Fusion. Science outreach panels. Panel: Prepare for Unforeseen Consequences: Scientific Discoveries with Surprising Outcomes. I presented microalgae to biofuels and food and particular unforeseen discoveries in my research. Phoenix Convention Center. Date: May 25th, 2019.

SERVICE ACTIVITIES

Anca Delgado

National Science Foundation proposal reviewer, Chemical, Bioengineering Environmental Transport Systems (CBET), 2019

Carole Flores

Culture Ripples Design Team Meeting, Christine Whitney Sanchez, UTO ASU, 12/3/19.
Equal Rights Amendment Advocacy Workshop, ERA Taskforce Az, October 2019
Equal Rights Amendment Tabling at Humanist Society Conference, December 2019
Legislative District 18 Precinct Committeeperson, Fall 2019
Legislative District 18 Book Club, Fall 2019
East Valley Women in Politics, Fall 2019

Caitlyn Hall

On-going environmental, sustainability, and emerging technology science advising at the Arizona Capitol.
American Geophysical Union Thriving Earth Exchange, Community Science Fellow, Ongoing.

Steven Hart

Taught General Biology in the Prison Biology Education Program at the Florence Prison

Ethan Howley

Taught General Biology in the Prison Biology Education Program at the Florence Prison

Hannah Ray

Taught General Biology in the Prison Biology Education Program at the Florence Prison

Bruce Rittmann

I was Chair of the Fellows Steering Committee of the Association of Environmental Engineering and Science Professors.

I am on the Program Committee of the IWA's 2020 Leading Edge Technology Conference, to be held in Reno, NV in June..

ANALYTICAL CAPABILITIES

Lucas Crane.	Water quality analysis.
Taylor Davis.	Machine learning, learning Tableau software, increased data analytics abilities, bland-altman statistical tool
Michael Edgar.	Luminescence, HPLC, NOM analysis.
Christine Lewis.	Origin pro data analysis,

Michael Pavia:	I took Introductory Spanish speaking course to prepare for my trip to Peru
Hannah Ray.	Developed skills in statistics modeling using SPSS

MICROBIAL METABOLISMS

Taylor Davis.	Fecal Inoculate, mixed composite fecal inoculate, used for inoculation of batch fecal bioreactors to test nitrogen utilization, stored in -80 C freezer on 2nd floor
Christine Lewis.	-psbB synechocystis cells are cultured and maintained continually in ISTBV rm 106

BIOPROCESSES UPSCALED

Chenwei Zheng.	The project of quaternary ammonium compounds (QAC), including the bioreactors' establishment and process
Yuhang Cai.	Anaerobic Biofilm Membrane Bioreactor Model, Pepsico, ASU which includes modeling
Michael Edgar.	Upscaled lab-scale slag project to a field-scale demonstration on a farm in Wisconsin for phosphate removal. included bioreactor design, flow design.
Christine Lewis.	Electro photo bioreactor fuel cells that we will eventually run with pump probe spectroscopy.
Mark Reynolds.	Enhanced methanogenesis in solid waste bioreactor landfill analogues. Funding from the NSF Center for Bio-mediated and Bio-inspired. Sampling from Southwest Regional Landfill (Buckeye, AZ) and Salt River Landfill (Scottsdale, AZ). Other relevant details is 16L working volume in a PVC pipe design. Modeling is desired but has not yet successfully executed.

SUSTAINABILITY PRACTICES

Sarah Arrowsmith.	Created and instituted Needles and Sharps Center Specific Training.
Yen-Jung Lai.	1.Reducing energy and chemical demands by managing microalgal membrane properties to enhance the sustainability of microalgal fuels 2. Mitigate the spreading of antibiotic resistant genes from biological treatment process.

Christine Lewis. I have taken my project that required considerable waste to almost zero waste by developing fuel cells that do not require plastics and disposables. I have changed my culturing protocols to reduce to less than half of the waste in the past.

Evelyn Miranda. Reuse of industrial by-product materials (example, spent brewing grains, Sugarcane bagasse, Sugar beet pulp)

Mark Reynolds. Molecular reagent request. By centralizing requests for reagents on a biweekly basis, this prevents excessive freezer use, minimizing our lab's power needs.

Matt Scholz. Working with Dr. Rebecca Muenich and team, we have been developing methods for using AI and remote-sensing data to map animal feeding operations across the country, in collaboration with Stanford University, Michigan State, the Environmental Policy and Law Center, and others. Also with Dr. Muenich, we have established a working group called the Phosphorus Transport Modeling Group, which brings together modelers, agronomists, and soil chemists from multiple academic institutes, USDA, and industry to improve the state of phosphorus transport modeling.

Thiago Stangherlin. I have performed experimentation in tubular reactors using the microalgae strain scenedesmus sp. The goal of the experiment is to compare batch reactors with semi-continuous (under different hydraulic retention times), using a low nutrient concentration in order to improve lipid productivity. The experimental results promoted valuable discoveries that will be used to create mathematical models to improve lipid and also protein productivity.

SPECIALIZED TRAINING

Carole Flores

Examining Biases that Impact Projects, ASU Project Management Network, 12/13/19.
Minors on Campus Training, ASU, 11/1/19.
Equal Rights Amendment Advocacy Workshop, ERA Taskforce Az, 10/26/19.
Lean Six Sigma Yellow Belt 2004 Training, Clay Taylor, 10/25/19.
Organizational Excellence Community of Practice, ASU, Tempe, 10/3/19.
ASU Financial Svcs Depositing University & ASU FndnFunds - Cash Handling, 10/1/19.
Gallup Strengths Assessment Workshop, ASU KED Financial Svc, Laura Boyd, 10/1/19.
NCURA Seminar: Cost Transfers; Minimizing the Need, Monitoring the Process and Management of Risk, Diana Weber and Kristi Bazata, 9/25/19.
NCURA Seminar: How to Prep to Receive an Award, Sam Munguia, ASU, RAA, 9/12/19.

Research Administration: Everything You Should Know, Ana Feliciano, Webinar, 9/11/19.
Project MgmntTool Highlight: Wrike, ASU Project Management (PM) Network, 8/13/19.
Sponsored Review - Award Activation Report, ASU, Sarah Kern, 8/13/19.
Intro to Project Management, ASU Project Management Network, 7/30/19.
Empower, Develop, Grow, and Engage (EDGE) Conversations, ASU KE, 7/3/19.

Christine Lewis

Science Writing Internship, Biodesign Institute, Spring of 2019 - Present.

I write articles for a global readership which are dispersed from ASU Biodesign, ASU NOW, Facebook and Twitter.

Graduate and Professional Student Association (GPSA) Representative at Large and Member, Fall 2019 - Present.

ASU CLAS Committee
External Affairs Committee
My focus is advocacy for grad students that are in the sciences, veterans and students with families, in addition to reaching out to Biodesign for any issues or concerns these constituents may have.

Az Science Policy Network Member, Fall 2019 - Present

Collaboration between science experts and legislature.

Preparing Future Faculty, ASU, Fall 2019

Course where I earned a certificate and provided two talks to the lab group on subjects covered.

Andrew Marcus — Mindfulness Leadership Certificate

AWARDS AND PROMOTIONS

Sarah Arrowsmith	Award for Excellence, Environmental Health and Safety, Nov 14th 2019; ASU Laboratory Safety Innovation Award, EH&S, Dec 4th 2019.
Anca Delgado	Special Congressional Recognition by U.S. Senator Martha McSally, Arizona, 2019 Quentin Mees Research Award, AZ Water Association, 2019
Rebecca Dietz	ASU Graduate and Professional Student Association (GPSA), Out-of-State Career Development Grant, 2019 September 29
Christine Lewis	Best Poster Presentation at the Nature Conference: Functional Dynamics - Visualizing Molecules in Action (see picture, below)
Hannah Ray	Ian C. Watson Fellowship for Membrane Advancement, AMTA, 2019-2020

Mark Reynolds	SoLS Fall 2019 scholarship | ASU School of Life Sciences
Analissa Sarno	Graduate College Completion Fellowship, Arizona State University Graduate College, Fall 2019-Spring 2020

TESTIMONIALS

The Swette Center for Environmental Biotechnology has provided us with vital infrastructure and contacts for moving forward the sustainability mission of the Sustainable Phosphorus Alliance and an imprimatur that legitimizes us in the eyes of our industry, government, academic, and civil society stakeholders. Matt Scholz

I am working on gut microbiome of children with Autism. In this interesting work, we are focusing on how gut microbiota is associated with autism and how we can modulate them using fecal microbiota transplantation therapy. SCEB, Biodesign institute provides a healthy and transparent research platform with great opportunity to work with expertise. Khemlal Nirmalkar

As an interdisciplinary scientist, there is no better place to be than the SWETTE Center. We work on the cutting edge of science to solve real world problems that make a difference. Christine Lewis.

Christine Lewis receives Best Poster award.