making an impact

Semi-annual Impact Report

Swette Strategic Investment Fund

January 2018 – June 2018

Prepared by Bruce E. Rittmann
Director and Regents' Professor

ASU Biodesign Institute
Arizona State University

Swette Center for Environmental Biotechnology

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.

2018 was a year of strong momentum for the Biodesign Swette Center for Environmental Biotechnology. This report highlights key advances that are paving the way for greater discoveries in 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 not only to attract the best and the brightest, but 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 grant from the National Institutes of Health for nearly $4 million, plus a $1.3-million grant from the Department of Defense.

- We also invested in our microbial photobioenergy team. This led to a $1-million grant from the Department of Energy. We continue to invest in the microbial photobioenergy area, because we have promising ideas for how to significantly enhance the productivity of photobioenergy systems.

- The Swette investment also allowed us to play a leadership role in a new initiative at ASU organized by President Michael M. Crow and George Poste. Called DECISIVE (Designed Collaborations for Integrated Scale in Visionary Exploration), the project seeks to stimulate new cross-university collaborations that have the potential to meet some of the world's most pressing challenges.

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.

How do we measure success?

The Swette Center is a major international player in the search for new ways to create a more sustainable human society. Our research, technologies, and people are the driving forces for improving environmental quality, creating truly renewable resources, and helping humans be healthier. How do we know that we are having a positive impact?

On the ground, our work is leading to technological advances that are helping society move towards better sustainability. For example, Swette Center research has established that fecal transplants can help those in the autism spectrum interact better with their families and colleagues—preliminary findings that are clearly of interest to a world and a nation where one in 68 children has an autism spectrum disorder. The U.S. alone saw a 30 percent increase from 2012 to 2014, as reported by the Centers for Disease Control and Prevention.

We were also able to demonstrate that our membrane biofilm reactor can convert toxic metals in mining wastewaters into highly valuable nanoparticles. We started a spin-off company to commercialize this exciting advance. And, we are scaling up microbial electrochemical cells to provide energy-neutral wastewater treatment for groups of 50 to 500 people in remote areas.

Our work is adding to an important body of knowledge in the field of environmental biotechnology. Some of the impacts occur primarily within the academia and are readily tabulated. For example, we **published 29 papers**, received **two additional research grants** in the past six months bringing our total to **26 ongoing research programs**, and **garnered 16 awards** over the past six months. We are proud of our long list of alumni who are leading the field and inspiring the next generation of environmental scientists.

More difficult to quantify, but certainly creating impact, are our outreach events that include teaching biology in prisons, involving undergraduates and high-schoolers in our research, and being a magnet for international visiting scientists and research collaborators.

OUR PEOPLE

Building strong leadership

Promotions. The Center's leadership is provided by six tenure-track faculty and one research professor. In May, **Hinsby Cadillo-Quiroz** was promoted to Associate Professor (with tenure) in the School of Life Sciences, and **Rosa Krajmalnik-Brown** was promoted to Full Professor in the School of Sustainable Engineering and the Built Environment. We celebrated with a Center brunch **(Figure 1)**, since success for one represents success for all. We talked about the process of faculty promotion so that our graduate students know what to expect in their academic futures.

Figure 1. Faculty (and family) attend promotion brunch. Pictured left to right: back Treavor Boyer, Cesar Torres, Bruce Rittmann, Rosa Krajmalnik-Brown, Yosi Wolchansky; front row Anca Delgado, Ann Hammond Cadillo, Hinsby Cadillo-Quiroz, Rina Wolchansky

Stockholm Water Prize, Bruce Rittmann. Professor **Bruce Rittmann** is a co-winner of the prestigious 2018 Stockholm Water Prize **(Figure 2).** "Together, Professors Rittmann and van Loosdrecht are leading, illuminating, and demonstrating the path forward in one of the most challenging human enterprises on this planet — that of providing clean and safe water for humans, industry, and ecosystems," said Torgny Holmgren, executive director of the Stockholm International Water Institute, in an article published in the April 2018 edition of *The Stockholm Waterfront*.

Figure 2 Professors Bruce Rittmann and Mark van Loosdrecht (Delft University of Technology share the 2018 Stockholm Water Prize.

CBBG Thrust Leader, Rosa Krajmalnik-Brown. Professor Rosa Krajmalnik-Brown continues to serve as a *t*hrust leader for Environmental Protection and Ecological Restoration (Thrust 2) **for the** Center for Bio-mediated and Bio-inspired Geotechnics **(Figure 3). As a CBBG researcher, she** leads a microbial metabolic exploration team that seeks to isolate microbes and develop enrichment cultures that metabolize hexavalent chromium, tricholorethane, perchlorate and other environmental pollutants for bioremediation purposes. Many of our Center members participate in CBBG research and travelled to Atlanta, GA for the Midyear Meeting for the Center for Bio-mediated, Bio-inspired Geotechnics, including Bruce Rittmann, Rosa Krajmalnik-Brown, Anca Delgado, Cesar Torres, Megan Altizer, Caitlyn Hall, and Srivatsan Mohana Rangan.

Figure 3. Dr. Krajmalnik-Brown leads the Environmental Protection thrust of the Center for Bio-mediated and Bio-inspired Geotechnics.

Developing career paths

Daewook Kang

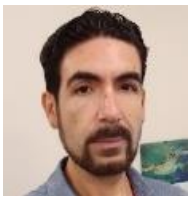
Daewook Kang was promoted from Assistant to Associate Research Scientist in May of 2018. He has participated in collaborations with the Translational Research Institute and Department of Defense on projects characterizing microbiomes associated with bioenergetics and autism.

Juan Maldonado Ortiz

Assistant Research Scientist **Juan Maldonado Ortiz** merged the Swette Center Microbiome Analysis with the College of Liberal Arts & Sciences Genomics Facility at the Biodesign Institute, to consolidate Next Generation Sequencing and bioinformatics resources and expertise to serve ASU and beyond in the discovery and characterization of microbiomes unique to their research.

Attracting the right people

The total number of people working in the Swette Center ranged from 90 to 105 people over the year. This includes graduate students, post-doctoral associates, undergraduate interns, high school interns, visiting scholars, and staff. Here are a few of our impressive newcomers.



Carlos Leyva

Carlos Leyva is an Electrical Engineer who graduated from ASU who started working for Future H_2O and Dr. Treavor Boyer, last year. He is working to build a cyber-physical system of water quality sensors to monitor the quality of the new Biodesign C building's drinking water as it goes from low occupancy to full.

Joshua Boltz

Dr. Joshua Boltz, a noted biofilm-process modeler and environmental-engineering practitioner, joined us in April. Considered an expert on the development and application of process models (particularly those describing biofilm reactors), his experience with [biofilm and biofilm reactor] research, model development and application, experimental and laboratory system design, and full-scale biofilm-reactor design and operations is extensive. Josh will begin at a Visiting Scientist, but we soon will make him a Research Engineer. He has deep expertise and interest in modeling biofilms processes used in aerobic wastewater treatment, and he also is taking a lead at modeling around selenate reduction and anaerobic wastewater treatment.

Chris Connot

Jigar Patel

Yesenia Moreno

New to the Krajmalnik-Brown Lab are Research Technicians **Chris Connot, Yesenia Moreno Caro**, and **Jigar Patel.** Mr. Connot will be assisting with molecular biology, chemical analysis, bioreactor culture and sampling, and bioinformatics pertaining to Dr. Krajmalnik-Brown's NIH project *Integrating Quantitative Energetics Determines the Microbiomes Contribution to Energy Balance*. Ms. Moreno Caro and Mr. Patel will be assisting with a project sponsored by Finch Therapeutics, *Enhanced Statistical Analysis of Phase 1 FMT Trial*, for which they will be conducting microbiome analyses for successful FMT trials for individuals with Autism Spectrum Disorder. Under the guidance of Research Scientist Daewook Kang, they will all be culturing microbes associated with the human gut as well as performing molecular biology needed to quantify their diversity in bioreactors and fecal samples and performing analytical chemistry to characterize their products.

Figure 4. University of Costa Rica collaborators Dr. Ana Gabriela Perez from the Greenhouse Gas and Carbon Capture Laboratory, Dr. Ana Mara Duran in the Geophysics Research Center, and Dr. Andrea Vincent from the Biology School.

Initiating world-wide collaborations

Costa Rica Collaboration, Hinsby Cadillo-Quiroz. Dr. Hinsby Cadillo-Quiroz recently visited the University of Costa Rica to develop a new collaboration with Dr. Ana Gabriela Perez from the Greenhouse Gas and Carbon Capture Laboratory, Dr. Ana Mara Duran in the Geophysics Research Center, and Dr. Andrea Vincent from the Biology School (**Figure 4).** Two pre-proposals were developed and submitted for joint research focusing on

Hinsby Cadillo-Quiroz

"Assessment of rural livelihood impacts on ecosystem services in a Costa Rica peatland complex and its connections to climate and policy making for conservation" plus the "Seasonal variations of carbon dioxide and methane emissions in a tropical river bog". Peatlands in Costa Rica have been understudied, some are under anthropogenic pressure by agriculture and fire and others are under climatic change regime. This collaboration aims to provide first records and solutions on how to manage these fragile ecosystems.

AEESP Chair, Treavor Boyer. Professor Treavor Boyer was selected as the Chair of the organizing committee to host the AEESP Research and Education Conference in May of 2019 at ASU. The AEESP conferences, the premier event for American professors of environmental engineering and science, are held every two years. ASU will host the first AEESP Conference in the Southwest.

Treavor Boyer

AEESP | Association of Environmental Engineering & Science Professors

1963-2013: Celebrating 50 Years of Advancing Environmental Engineering & Science

Bruce Rittmann

U6MP, Bruce Rittmann. The University of Mohamed 6 Polytechnic is a new university in Morocco. Mohamed 6 is the king of Morocco. UM6P came to ASU a couple years ago with a request to help them get started, and Dr. Rittmann is leading that charge. We are slated to begin a new project on recovering sulfur and rare-earth metals from the wastewater that comes from mining phosphate rock. Morocco controls around 70% of the world's phosphate reserves; so, phosphate is big business in Morocco. We will adapt our membrane biofilm reactor for this purpose. Dr. Rittmann will visit Morocco in July of 2018, and the new project should begin in September.

Figure 5 UM6P campus

Figure 6 Phosphate mining in Morocco

Isa Peraza

Mayan Culture and Environmental Engineering. As part of a Climate Change course he took this Spring, **Isa Peraza** (PhD student in Environmental Engineering) wrote a research paper titled: The different theories to explain the great Maya collapse influenced by climatic events. Isa is from the Yucatan, is a Mayan scholar, and teaches about the Mayan language. Isa Peraza collaborated to create a curriculum for a summer class in fundamental of scientific research in the natural sciences a class planned to high School students that are a subsection of the Yucatan State University

Neng Iong Chan

United Nations Internship. Neng Iong Chan (PhD student in Life Sciences) won a 2018 May Joint FAO/IAEA Programme internship in Soil and Water Management & Crop Nutrition Section. His internship is at the United Nations Food and Agriculture Organization/International Atomic Energy Agency, Vienna, Austria.

Exploring commercialization

NSF National I-Corps Program. The NSF's I-Corps program provides entrepreneurship training for scientists and engineers to help transition their technologies to the marketplace, with a strong focus on customer discovery. We had three teams from the Swette Center participate: **Dr. Anca Delgado and Megan Altizer** working on a novel reactor for growing dechlorinating bacteria, **Dr. César Torres and Dr. Georgios Papacharalampos** working on applications of microbial electrochemical cells (MECs) in wastewater, and **Dr. Leon van Paassen and Caitlyn Hall** working on a bioinspired technology to repair dam infrastructure (**Figure 5**). Dr. van Paassen and Cailyn Hall advanced to the national level and just completed the program.

Figure 5. VanPaassen and Hall visit Indianapolis, Indiana for three days of interviews with industry professionals.

Matt Scholz

Sustainable Phosphorus Alliance. The Swette Center continues to host the Sustainable Phosphorus Alliance, (SPA) an organization that functions as an industry nonprofit that promotes the sustainable use, recovery, and recycling of phosphorus in the food system. **Matt Scholz** is the Director of SPA. Leveraging that support, the Alliance hosted its second annual Phosphorus Forum event on the Tempe campus on February 26th, attracting some 60 participants, mostly from industries across the US and Canada (**Figure 6**). The event brought these participants from across the phosphorus value chain together for knowledge sharing and networking. Video footage of the day's events is available at https://youtu.be/8A9NFkSwji8.

Figure 8. 2nd Annual Phosphorus Forum, Tempe, AZ

Modeling our mission

Daniella Saetta

Carlos Leyva

Biodesign Water Quality, Boyer Lab. Engineer **Carlos Leyva**, PhD student **Daniella Saetta**, Masters student **Rebecca Dietz**, and **Professor Treavor Boyer** are leading The Biodesign C Water Quality Project, which is funded by the ASU Future H2O initiative. The goal of the project is to create a tool for building occupants based on the water quality in a newly constructed green building with a focus on human health. The tool will be able to inform users on the real-time water quality within the building. Water samples are taken twice a week and on-line monitors are placed in the building for continuous water quality analysis (Figure 7). Predictive models will be made with the water quality data to actuate valves used to move aged water out of the system. Green building design has long used "smart" energy systems to reduce their use of energy, while providing a satisfying work environment. This "smart" water system fills the void of technologies available for water quality monitoring in green buildings of the future.

Figure 6. Biodesign C online instrument

Burcu Yavuz

Green Events. Led by PhD student **Burcu Yavuz**, our Center is leading by example by giving our monthly birthday and other celebrations a sustainability makeover. Since we are dedicating our lives to sustainable principles, we seek to convince the world that "the concept of waste or waste products is obsolete (Rittmann, 2018)". For example, we celebrated Dr. Hinsby and Dr. Rosy's promotions without generating waste. We requested recyclable materials (aluminum and plastic) from our catering vendor. We provided compostable plates and a bag for organic waste. As we ate, sorted, cleaned, and tallied our numbers, it became clear how good this felt and how easy it can be if we all chip in.

Left to right: *top row* Sayalee Joshi weighs waste and calculates distributions, nearly 75% of all aluminum ever produced is still in use so recycle it, was this actual trash even necessary; *middle row* single-use plastics are very dangerous in the ocean, Steven Hart and Isa Peraza weighed our compostable waste; bottom row Shefali Rao and others helped clean recyclable and reusable items, some of the Center members who attended the party celebrate zero waste!

The final numbers and the pictures are inspiring. We generated about 7.2 kg of waste. Of that waste, 42% was organic compostable material (that is the number the literature always comes up with!), 51% was recyclable, and 7% was reusable. The only waste that absolutely had to go to landfill was mainly single use plastic and some plastic lined cups that weighed in at about 0.7% of the total mass we generated. Even that is avoidable in the future. In summary, had we thrown things into the trashed we would have missed an opportunity to reduce our waste by two orders of magnitude, and it wasn't even hard to do the opposite.

As leaders, we should consider ways in which we can build on these small successes to make our world more beautiful. It is wonderful to live by our principles and it is even more wonderful to apply the things we learn to our work. We are thankful for the gracious participation of everyone in our Center. We've learned that we need to ask caterers to avoid single-use containers (e.g. syrup, butter, and creamer) and we're hoping that these principles can be adopted by the Biodesign Institute as a whole.

	Category	Mass (kg)	Percent	Category Percent
Compost	Compost	3.010	41.7%	41.7%
Syrup Cups	Landfill	0.018	0.2%	
Butter Cups	Landfill	0.003	0.0%	
Coffee Creamer cups	Landfill	0.011	0.2%	
Stir sticks	Landfill	0.001	0.0%	0.5%
aluminum	Recyclable	2.180	30.2%	
Sterno Aluminum/Tin	Recyclable	0.174	2.4%	
Plastic Containers	Recyclable	0.413	5.7%	
Plastic Cups	Recyclable	0.190	2.6%	
Plastic Jugs	Recyclable	0.370	5.1%	
Plastic Caps	Recyclable	0.010	0.1%	
Soft plastic	Recyclable	0.060	0.8%	
Cardboard	Recyclable	0.285	3.9%	51.0%
Provided plastic utensil	Reusable	0.236	3.3%	
Plastic Cutlery	Reusable	0.265	3.7%	6.9%
Total		**7.226**	**100.0%**	**100.0%**

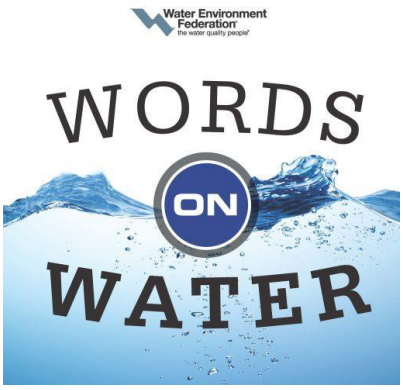
The following section documents the Center's achievements in these categories:

- **Research Activities and Outputs**
- **Mentoring Activities**
- **Special Activities and Impacts**
- **Awards and Accolades**
- **Alumni Success**

2018 HIGHLIGHTS

Research activities and outputs, January – June 2018

29 publications and media, 5 high-profile examples



- In a May 28, 2018 podcast, Dr. Bruce Rittmann shared stories about using microbial communities to transform pollutants into resources, applying mathematical modeling to optimize treatment processes, and about how working at a wastewater plant influenced his career.

- Microbiota Transfer Therapy alters gut ecosystem and improves gastrointestinal and autism symptoms: an open-label study, by **Rosa Krajmalnik-Brown** and **Dae-Wook Kang** et al and published in *Microbome,* was selected to appear as a must-read article as part of the 2018 Springer Nature Change the World initiative.

- Boyer Lab Video. ASU students **Claire Cleveland, Jenna Miller, Garr Punnett,** and **Grace Clark** filmed and edited a sustainability documentary titled **Peecycling: The #1 Solution**, in which members of the Boyer Lab describe various strands of research that involve pharmaceutical removal and resource recovery from an abundant resource: urine. Transforming nutrient use from a destructive linear flow into a sustainable cycle, or "peecycle," can result in a sustainable source of fertilizers to replace chemical fertilizers and prevent eutrophication of lakes and other water bodies. The video also highlights the importance of outreach and education to change the public's perspective about harvesting resources from urine.

- **Dr. Rosa Krajmalnik-Brown** was on the committee of the National Academies of Sciences, Engineering, and Medicine that released Advancing Understanding of the Implications of Environmental-Chemical Interactions with the Human Microbiome. Environmental Chemicals, the Human Microbiome, and Health Risk: A Research Strategy. Washington (DC): National Academies Press (US); 2017 Dec 29.Available from: https://www.ncbi.nlm.nih.gov/books/NBK481560/ doi: 10.17226/24960.

- Korean PBS interviewed **Drs. Rosa Krajmalnik-Brown, Dr. Daewook Kang,** and **Dr. James Adams** to discuss promising fecal microbial transplant research results featured in a three-part YouTube series. Joe Kullman authored an article in FSE Full Circle featuring the collaborative project that explores microbiome treatments for people with autism. Read the full article here.

48 presentations at conferences, universities, and other research laboratories, and six examples

- **Hart, S.**, Young, M., Ki, D., Brown, S., Wilson, C., Parameswaran, P., Torres, C.I. "Improved Characterization of Anaerobic Digestion Kinetics of Mixed Sludges With and Without Thermally Pretreated WAS" for the WEF Residuals and Biosolids, Phoenix, AZ, 2018.
- **Ki, D.**, Kupferer, R., Torres, C.I. "Primary sludge to valuable chemicals, hydrogen peroxide (H_2O_2), in microbial electrochemical cells: H_2O_2 production and in-situ sludge treatment" for the WEF Residuals and Biosolids, Phoenix, AZ, 2018 (Podium Presentation).
- **Mohana Rangan**, **S.,** A. Mouti, A.G. Delgado, R. Krajmalnik-Brown, G.V. Lowry, L. LaPat-Polasko, and H. Brenton. Trade-Offs in Utilizing Zero-Valent Iron for Synergistic Biotic and Abiotic Reduction of Trichloroethene and Perchlorate. Srivatsan Mohana Rangan (Arizona State University/USA). Battelle 2018. Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Palm Spring California. April 2018.
- **Peraza,I.** Presented a talk titled: Mathematical modeling of electroactive biofilms at the first meeting of CONACYT fellowships in United States in Washington DC from 15 to 17 of March.
- **Rittmann, B.E.** Invited lecture, "Including Biofilm Detachment in Models. NSF-sponsored workshop on Mechanical Properties of Biofilms," University of Notre Dame, South Bend, IN. April 23, 2018.
- **Rittmann, B.E.** Invited lecture, "Roux-en-Y Gastric Bypass Surgery Shifts Gut Microbial Communities and Associated Metabolites," Soochow University, Suzhou, PRC. June 8, 2018.

1 patent application pending.

26 externally funded research projects
from **18** U.S. federal agencies (National Science Foundation, National Institutes of Health, Department of Energy, Department of Defense, and NASA)
Other funders included foundations, industries, and foreign agencies.

Mentoring activities

- **7** degrees earned: **2** PhDs, **1** Masters, and **4** Bachelors
- **41** graduate students, **4** post-doctoral associates, and **3** research scientists
- **28** undergraduates, including **1** Swette Undergraduate Sustainability Intern and **3** Fulton Undergraduate Research Initiative Scholars
- **5** visiting scholars
- **3** high school student and **1** teacher
- **3** volunteer researchers

Special activities – highlights (see appendix for comprehensive list)

- Faculty member Rosa Krajmalnik-Brown was invited to participate in the National Academies of Science, Engineering, and Medicine Committee on Advancing Understanding of the Implications of Environmental-ChemicalInteractions with the Human Microbiomes
- Ph.D. Student Neng Iong Chan was selected as a Collaborated to create a curriculum for a summer class in fundamental of scientific research in the natural sciences a class planned to high School students that are a subsection of the Yucatan State University
- Ph.D. Student Isaias Peraza co-designed a curriculum for a summer class in the fundamentals of scientific research in the natural sciences for high school students that are a subsection of the Yucatan State University
- Director Bruce Rittmann participated in the Fellows Steering Committee for the Association of Environmental Engineering and Science Professors

Awards and accolades – highlights (see appendix for comprehensive list)

16 awards to **12** individuals, including:

- **5** Dean's Fellowships from the Fulton Schools of Engineering
- **2** best-paper winners
- **3** travel grants
- 1 Stockholm Water Prize!

Alumni success

A measure of our alumni success is the number of PhD and post-doc alumni who are now tenured or tenure-track professors at major universities around the world. These include:

- **Sofia Esquivel Elizondo** secured a postdoctoral research fellowship at the Max Planck Institute for Developmental Biology in Tübingen, Germany.

- **Zehra (Esra) Ilhan** secured a postdoctoral research fellowship at the University of Arizona in Phoenix, Arizona.
- **Levi Straka** secured a postdoctoral research fellowship at the University of Washington in the Civil and Environmental Engineering Department.
- **Aura Ontiveros Valencia** completed a postdoctoral research fellowship at the ITESM Campus and ITESM, a postdoctoral research fellowship at the University of Notre Dame, and has been appointed as an Assistant Research Professor at the Tecnológico de Monterrey in Puebla de Zaragoza, Mexico.
- **Avni Solanki** will begin a lecturer position at Washington University in St. Louis in the Department of Energy, Environmental, and Chemical Engineering in Fall of 2018.
- **Prathap Parameswaran**, now Assistant Professor in Civil Engineering at Kansas State University, is one of five recipients of the first award issued by the Kansas NSF EPSCoR, which supports early career research related to Microbiomes of Aquatic, Plant and Soil Systems. **Dr. Parameswaran's** project, Smart adaptation of enriched microbiomes in Recovered Nutrient Products (bio-fertilizers) from anaerobic wastewater treatment to the native soil, is profiled by this article.

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-

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 lead 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 LEADERSHP

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

Appendix

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

New babies!

Above: proud parents of Baby Silvia: Cesar Torres & Anca Delgado

Baby Ian Dojun Ki
(Papa Dongwon Ki - BSCEB Postdoc)

Baby Bella, her pup and her lab cousin Baby Silvia
(Momma Diana Calvo Martinez BSCEB PhD student)

Research activities and outputs

Funded research

Faculty in the Swette Center have achieved success in leveraging the Swette Strategic Investment to obtain new research projects, including a number of large awards. The table below lists major new projects.

Sponsor	Principal Investigator	Title and Award Amount
Aquarius Technologies, LLC (7/15/18-1/14/19)	PI Bruce Rittmann and Joshua Boltz	*A model of selected microfauna and meiofauna predation in a biofilm reactor,* **$20,002**
Finch Therapeutics/Crestovo (3/1/18-9/30/18)	PI Krajmalnik-Brown	*Microbiome analyses for successful FMT trials for individuals with ASD,* **$90,013**
DOD-ARMY-USAMRAA W81XWH-16-1-0492 (9/1/16-8/31/20)	PI Adams co-PI Krajmalnik-Brown	*Treating gastrointestinal and autism symptoms in adults with autism using Microbiota Transfer Therapy (MTT),* **$ 1,293,794**
ASU Foundation, 30007312	PI Adams, co-PI Krajmalnik-Brown	*Long-term Follow-up on Beneficial Bacteria Treatment Study,* **$28,008**
NSF-ENG-CBET, CAREER 1713704 (7/15/2016 - 12/31/2018)	PI Boyer	*Sustainable Urine Processes through integration of Education and Research,* **$156,627**
NASA-GODDARD SPACE FLIGHT CTR NNX15AD53G (12/31/14-12/30/19)	co-PI Cadillo-Quiroz	*Exoplanetary Ecosystems: Exploring Life's Detectability on Chemically Diverse Exoplanets,* **$6,097,436**
NSF-GEO-OCE 1658527 (3/15/17-2/29/20)	co-PI Cadillo-Quiroz	*Aggregation of Marine Picoplankton,* **$687,521.00**
NSF-BIO-DEB 1355066 (5/1/14-4/30/19)	PI Cadillo-Quiroz	*Collaborative Research: Forest productivity and hydrological patterns regulate methane fluxes from peatlands in the Amazon basin,* **$626,999.00**
NSF-BIO-DEB 1637590 (12/1/16-11/30/18)	co-PI Cadillo-Quiroz	*LTER CAP IV: Design with Nature,* **$4,508,000**
CHEVRON ENERY & TECH. CORP CW1022841/14072019 (1/27/14-6/30/18)	PI Johnson co-PIs Delgado, Karjmalnik-Brown, Rittmann	*In-Situ Remediation of Heavy Hydrocarbons in Impacted Vadose Zone Soils: Strategy and Management Approach for Innovation, Chevron Energy and Technology Company,* **$2,075,233**
National Science Foundation, NSF-ENG-EEC 1449501 (08/01/17–07/31/18)	PI Kavazanjian, Co-PIs Krajmalnik-Brown, Torres, Rittmann, Boyer, Cadillo-Quiroz	*Center for Bio-mediated and Bio-inspired Geotechnics***, $18-million**
National Institutes of Health, HHS-NIH 1R01DK105829-01A1 (9/1/16-6/30/21)	PI Krajmalnik-Brown, co-PIs Rittmann, Marcus	*Integrating Quantitative Energetics Determines the Microbiomes Contribution to Energy Balance*, **$3,936,800**
Mayo Clinic Arizona ARI-225822 (3/1/17-8/31/18)	co-PI Krajmalnik-Brown	*Obesity in Menopause: The role of estrogen therapy on the gut microbiome and host,* **$50,000**

Department of Energy, DOE DE-EE0007562 (10/1/16-9/30/18)	PI Lammers, co-PI Krajmalnik-Brown	*A novel platform for algal biomass production using cellulosic mixotrophy,* **$1,689,791**
Department of Energy, DOE-EERE DE-EE0007093 (10/1/15-9/30/18)	PI Rittmann,	*Atmospheric CO2 Capture and Membrane Delivery,* **$1 million**
National Science Foundation, NSF-ENG 1509933 (7/1/15-6/30/19)	PI Rittmann	*Targeted saturated fatty acids synthesis by microbial biohydrogenation and its superior extraction from microalgae biomass through fermentation,* **$309,443**
Sponsor	**Principal Investigator**	**Title and Award Amount**
National Science Foundation, NSF-ENG 1702445 (7/1/17-6/30/20)	PI Rittmann	*Enhancing Biodegradation of Quaternary Ammonium Compounds (QAC),* **$329,738**
Lightworks – FY18	PI Rittmann	*Growth conditions affecting biomass competition for calcifying Emiliania huxleyi in a direct membrane-carbonation photobioreactor,* **$13,046**
GIOS – FY18	PI Rittmann Co-PIs Krajmalnik-Brown, Torres, Marcus, Boyer, Cadillo-Quiroz	*Swette Undergraduate Scholar Fund*
Department of Defense, DOD-SERDP W912HQ-17-C-0013 (04/01/17-04/05/19)	PI Rittmann co-PI Krajmalnik-Brown	*Synergistic Reductive Dechlorination of 111-Trichloroethane and Trichloroethene,* **$200,000**
National Science Foundation, NSF-ENG 1603656 (7/1/16-6/30/19)	PI Rittmann, co-PI Torres	*SusChEM: Engineering the Hollow-Fiber Membrane Biofilm Reactor to Convert Syngas to Valuable Products,* **$209,022**
Department of Defense, DOD-NAVY-ONR N00014-15-1-2702 (9/1/15-10/31/18)	PI Torres co-PI Krajmalnik-Brown	*Combining Electrochemical -Omics and Microscopic Approaches to Characterize Transport Limitations in Anode-Respiring Bacteria Biofilms,* **$448,955**
Department of Defense, DOD-NAVY-ONR N00014-15-1-2571 (05/01/15-04/3018)	PI Torres	*Development of Substrate-loaded Microbial Fuel Cells for Powering Remote Sensors,* **$399,775**
NSF-EHR-DGE 1144616 (07/01/12-06/30/18)	PI Vermaas co-PI Torrres	*IGERT: Solar Utilization Network (SUN),* **$3,006,642**
NSF-BIO-DBI 1531991 (09/01/15-08/31/18)	PI Spence Co-PI Torres	*MRI: Acquisition of Cryo-EM for Southwest Regional Center,* **$2,825,509**
Center for Applied Structural Discovery Start-Up – FY18	**PI Fromme** **co-PI Torres**	**Microbial Electro-Photosythesis (MEPS)**

Patents issued, licensed, or applications pending

(Current Swette Center members in boldface)

Rittmann, B., Klaus, L., Justin, F., **Megha, P.**, & Allen, W. (2018). Systems and methods of atmospheric carbon dioxide enrichment and delivery to photobioreactors via membrane carbonation. U.S. Patent No. 15/564,862. Washington, DC: U.S. Patent and Trademark Office (application pending).

Papers published or accepted in the first half of 2018

(Current Swette Center members in boldface)

1. Alemán-Nava, G. S., Gatti, I. A., Parra-Saldivar, R., Dallemand, J., **Rittmann, B. E.**, & Iqbal, H. M. (2018). Biotechnological revalorization of Tequila waste and by-product streams for cleaner production – A review from bio-refinery perspective. *Journal of Cleaner Production*, 172, 3713-3720. doi:10.1016/j.jclepro.2017.07.134.
2. Alrashed, W., Lee, J., Park, J, **Rittmann, B.E.**, Tang, Y., Neufeld, J.D., Lee, H.S. (2018). Hypoxic methane oxidation coupled to denitrification in a membrane biofilm. *Chemical Engineering Journal*, 348, 745-753. https://doi.org/10.1016/j.biortech.2013.03.115.
3. Burke, R. D., Dancz, C. L., Ketchman, K. J., Bilec, M. M., **Boyer, T. H.**, Davidson, C., . . . Parrish, K. (2018). Faculty Perspectives on Sustainability Integration in Undergraduate Civil and Environmental Engineering Curriculum. *Journal of Professional Issues in Engineering Education and Practice*, 144(3), 04018004. doi:10.1061/(asce)ei.1943-5541.0000373.
4. Chen, T., **Yavuz, B. M.**, **Delgado, A. G.**, **Montoya, G.**, Winkle, D. V., Zuo, Y., . . . **Rittmann, B. E.** (2018). Impacts of moisture content during ozonation of soils containing residual petroleum. *Journal of Hazardous Materials*, 344, 1101-1108. doi:10.1016/j.jhazmat.2017.11.060
5. **Chen, T.**, **Yavuz, B. M.**, **Delgado, A. G.**, **Montoya, G.**, **Winkle, D. V.**, Zuo, Y., . . . **Rittmann, B. E.** (2018). Impacts of moisture content during ozonation of soils containing residual petroleum. *Journal of Hazardous Materials*, 344, 1101-1108. doi:10.1016/j.jhazmat.2017.11.060.
6. **Esquivel-Elizondo, S.**, **Maldonado, J.**, & **Krajmalnik-Brown, R.** (2018). Anaerobic carbon monoxide metabolism by Pleomorphomonas carboxyditropha sp. nov., a new mesophilic hydrogenogenic carboxydotroph. *FEMS Microbiology Ecology*, 94(6). doi:10.1093/femsec/fiy056.
7. **Ginkel, S. W.**, **Miceli, J.**, Kim, B., Yang, Z., **Young, M.**, **Marcus, A.**, & **Rittmann, B. E.** (2018). Determining the Mechanism for Low Sludge Yields in the Cannibal Solids Reduction System. *Water Environment Research*, 90(1), 42-47. doi:10.2175/106143017x14839994523947.
8. **Ginkel, S. W.**, **Miceli, J.**, Kim, B., Yang, Z., **Young, M.**, **Marcus, A.**, & **Rittmann, B. E.** (2018). Determining the Mechanism for Low Sludge Yields in the Cannibal Solids Reduction System. Water Environment Research, 90(1), 42-47. doi:10.2175/106143017x14839994523947.
9. **Hobbs, S. R.**, Landis, **A. E.**, **Rittmann, B. E.**, **Young, M. N.**, & **Parameswaran, P.** (2018). Enhancing anaerobic digestion of food waste through biochemical methane potential assays at different substrate: Inoculum ratios. *Waste Management*, 71, 612-617. doi:10.1016/j.wasman.2017.06.029.
10. Kushwaha, S., **Marcus, A. K.**, & **Rittmann, B. E.** (2018). PH-dependent speciation and hydrogen (H2) control U(VI) respiration by Desulfovibrio vulgaris. *Biotechnology and Bioengineering*, 115(6), 1465-1474. doi:10.1002/bit.26579.
11. Lai, C., Lv, P., Dong, Q., Yeo, S. L., **Rittmann, B. E.**, & Zhao, H. (2018). Bromate and Nitrate Bioreduction Coupled with Poly-β-hydroxybutyrate Production in a Methane-Based Membrane Biofilm Reactor. *Environmental Science & Technology*, 52(12), 7024-7031. doi:10.1021/acs.est.8b00152.
12. Lanzarini-Lopes, M., **Delgado, A. G.**, Guo, Y., Dahlen, P., & Westerhoff, P. (2018). Optical fiber-mediated photosynthesis for enhanced subsurface oxygen delivery. *Chemosphere*, 195, 742-748. doi:10.1016/j.chemosphere.2017.12.089.
13. Li, A., **Zhou, C.**, Liu, Z., Xu, X., Zhou, Y., Zhou, D., . . . **Rittmann, B. E.** (2018). Cover Image, Volume 115, Number 7, July 2018. *Biotechnology and Bioengineering*, 115(7), I-I. doi:10.1002/bit.26421.
14. Li, A., **Zhou, C.**, Liu, Z., Xu, X., Zhou, Y., Zhou, D., . . . **Rittmann, B. E.** (2018). Direct solid-state evidence of H2-induced partial U(VI) reduction concomitant with adsorption by extracellular polymeric substances (EPS). *Biotechnology and Bioengineering*, 115(7), 1685-1693. doi:10.1002/bit.26592.

15. Liu, Z., **Zhou, C.**, **Ontiveros-Valencia, A.**, Luo, Y., **Long, M.**, Xu, H., & **Rittmann, B. E.** (2018). Accurate O2 delivery enabled benzene biodegradation through aerobic activation followed by denitrification-coupled mineralization. *Biotechnology and Bioengineering*. doi:10.1002/bit.26712.
16. **Lusk, B. G.**, **Peraza, I.**, Albal, G., **Marcus, A. K.**, **Popat, S. C.**, & **Torres, C. I.** (2018). PH Dependency in Anode Biofilms of Thermincola ferriacetica Suggests a Proton-Dependent Electrochemical Response. *Journal of the American Chemical Society*, 140(16), 5527-5534. doi:10.1021/jacs.8b01734.
17. Medina, B. B., **Boyer, T.**, & Indarawis, K. (2018). Evaluating Options for Regenerant Brine Reuse in Magnetic Ion Exchange Systems. Journal - American Water Works Association, 110(5). doi:10.1002/awwa.1046.
18. **Nguyen, B. T.**, & **Rittmann, B. E.** (2018). Low-cost optical sensor to automatically monitor and control biomass concentration in microalgal cultivation. *Algal Research*, 32, 101-106. doi:10.1016/j.algal.2018.03.013.
19. **Ray, H.**, **Saetta, D.**, & **Boyer, T. H. (2018)**. Characterization of urea hydrolysis in fresh human urine and inhibition by chemical addition. Environmental Science: *Water Research & Technology*, 4(1), 87-98. doi:10.1039/c7ew00271h.
20. **Rittmann, B. E.**, **Boltz, J. P.**, Brockmann, D., Daigger, G. T., Morgenroth, E., Sørensen, K. H., . . . Vanrolleghem, P. A. (2018). A framework for good biofilm reactor modeling practice (GBRMP). Water Science and Technology, 77(5), 1149-1164. doi:10.2166/wst.2018.021.
21. Song, J., Chen, L., Chen, H., Sheng, F., Xing, D., Li, L., . . . **Rittmann, B.** (2018). Characterization and high-throughput sequencing of a trichlorophenol-dechlorinating microbial community acclimated from sewage sludge. *Journal of Cleaner Production*, 197, 306-313. doi:10.1016/j.jclepro.2018.06.061.
22. **Straka, L.**, & **Rittmann, B. E.** (2018). Dynamic response of Synechocystis sp. PCC 6803 to changes in light intensity. *Algal Research*, 32, 210-220. doi:10.1016/j.algal.2018.04.004.
23. **Straka, L.**, & **Rittmann, B. E.** (2018). Light-dependent kinetic model for microalgae experiencing photoacclimation, photodamage, and photodamage repair. *Algal Research*, 31, 232-238. doi:10.1016/j.algal.2018.02.022.
24. **Tejedor-Sanz, S.**, Fernández-Labrador, P., **Hart, S.**, **Torres, C. I.**, & Esteve-Núñez, A. (2018). Geobacter Dominates the Inner Layers of a Stratified Biofilm on a Fluidized Anode During Brewery Wastewater Treatment. *Frontiers in Microbiology*, 9. doi:10.3389/fmicb.2018.00378.
25. Xiong, H., Dong, S., Zhang, J., Zhou, D., & **Rittmann, B. E.** (2018). Roles of an easily biodegradable co-substrate in enhancing tetracycline treatment in an intimately coupled photocatalytic-biological reactor. *Water Research*, 136, 75-83. doi:10.1016/j.watres.2018.02.061.
26. Yang, C., Tang, Y., Xu, H., Yan, N., Li, N., Zhang, Y., & **Rittmann, B. E.** (2018). Competition for electrons between mono-oxygenations of pyridine and 2-hydroxypyridine. *Biodegradation*. doi:10.1007/s10532-018-9834-0.
27. Zhou, D., Dong, S., **Ki, D.**, & **Rittmann, B. E.** (2018). Photocatalytic-induced electron transfer via anode-respiring bacteria (ARB) at an anode that intimately couples ARB and a TiO 2 photocatalyst. *Chemical Engineering Journal*, 338, 745-751. doi:10.1016/j.cej.2018.01.094.
28. Zhou, Y., **Eustance, E.**, **Straka, L.**, **Lai, Y. S.**, Xia, S., & **Rittmann, B. E.** (2018). Quantification of heterotrophic bacteria during the growth of Synechocystis sp. PCC 6803 using fluorescence activated cell sorting and microscopy. *Algal Research*, 30, 94-100. doi:10.1016/j.algal.2018.01.006
29. Zou, S., Zhang, B., Yan, N., Zhang, C., Xu, H., Zhang, Y., & **Rittmann, B. E.** (2018). Competition for molecular oxygen and electron donor between phenol and quinoline during their simultaneous biodegradation. *Process Biochemistry*, 70, 136-143. doi:10.1016/j.procbio.2018.04.015.

Proceedings and presentations

(Swette Center presenter in bold)

1. **Altizer M**, Delgado AG, Krajmalnik-Brown R, Torres CI, Wang J, Cox E. The influence of electrokinetic bioremediation on subsurface microbial communities in perchloroethylene contaminated soil. Battelle Eleventh International Conference on Remediation of Chlorinated
2. **Altizer M.L.**, A.G. Delgado, R. Krajmalnik-Brown, C. Torres, J. Wang, and E. Cox. The Influence of Electrokinetic Bioremediation on Subsurface Microbial Communities in Perchloroethylene Contaminated Soil. Megan Leigh Altizer (Enoveo USA/USA). Battelle 2018. Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Palm Spring California. April 2018.
3. **Barbosa T**, Mulchandani A, Rittmann BE. Modeling microalgae *Scenedesmus* sp. to maximize lipid production. 8th International Conference on Algal Biomass, Biofuels and Bioproducts, June 11 - 13, 2018, Seattle, WA.
4. **Boyer, T.H.**, 2018. Pilot-Scale Evaluation of Bicarbonate-Form Anion Exchange for Small Systems. Presented at *255th American Chemical Society National Meeting & Exposition*, New Orleans, Louisiana, 18–22 March 2018.
5. **Calvo-Martinez**, D., Ontiveros-Valencia, A., Maldonado-Ortiz, J., Torres, C.I., Krajmalnik-Brown, R., Rittmann, B.E., "Acetate production by anaerobic, autotrophic bacteria in an H2-based Membrane Biofilm Reactor". 254th American Chemical Society National Meeting and Exposition. August 20-24, 2017. Washington. D.C.
6. **Chen, T.,** Yavuz, B.M**.,** Rittmann, B.E. (01.29.2018). Heavy Petroleum Hydrocarbons Remediation using Ozonation and Bioremediation—Progress Report. **Presenter** at the semiannual Chevron soil remediation project meetings, Houston, TX
7. Hall C., G. Hernandez, K. Darby, L. van Paassen, **E. Kavazanjian**, J. DeJong, and D. Wilson. *Centrifuge Model Testing of Liquefaction Mitigation via Denitrification-Induced Desaturation*. Geotechnical Earthquake Engineering and Soil Dynamics V (GEESD V), Austin, TX, June, 2018.
8. **Hall C.A.**, L. van Paassen, E. Kavazanjian, and B. Rittmann. Microbially Induced Desaturation and Precipitation (MIDP) via Denitrification During Centrifugal Loading. Interpore, New Orleans, LA. May, 2018
9. Hall C.A., **Y. Smit**., and M. Altizer. Journal for the Unpublishable: "Bad" Data and Non-Discovery^2. European Geoscience Union Assembly, Vienna, Austria. March, 2018.
10. **Hall C.**, Leon van Paassen, Edward Kavazanjian, Jason DeJong, Dan Wilson. *Evaluation of Biogenic Gas Formation by Denitrification in Centrifuge^2* 7th International Conference on Unsaturated Soils (UNSAT 2018). Hong Kong, China, August 2018.
11. **Hall C.**, Leon van Paassen, Edward Kavazanjian, Jason DeJong, Dan Wilson. *Evaluation of Biogenic Gas Formation by Denitrification in Centrifuge^2* 7th International Conference on Unsaturated Soils (UNSAT 2018). Hong Kong, China, August 2018.
12. **Hart, S.**, Young, M., Ki, D., Brown, S., Wilson, C., Parameswaran, P., Torres, C.I. "Improved Characterization of Anaerobic Digestion Kinetics of Mixed Sludges With and Without Thermally Pretreated WAS" for the WEF Residuals and Biosolids, Phoenix, AZ, 2018.
13. Kavazanjian E., Sean O'Donnell, Bruce Rittmann, Nasser Hamdan, **Caitlyn Hall**, and Leon van Paassen. *Mitigation of Liquefaction Beneath Existing Facilities Using Denitrification*. 11th U.S. National Conference on Earthquake Engineering. Los Angeles, CA, June 2018.

14. **Ki, D.**, Kupferer, R., Torres, C.I. “Primary sludge to valuable chemicals, hydrogen peroxide (H_2O_2), in microbial electrochemical cells: H_2O_2 production and in-situ sludge treatment” for the WEF Residuals and Biosolids, Phoenix, AZ, 2018 (Podium Presentation).
15. **Liu Y**, Lai YS, Barbosa T, Chandra R, Parameswaran P, Bruce E. Rittmann (2018). Electro-selective fermentation enhances lipid extraction and biohydrogenation of *Scenedesmus acutus* biomass. 8th International Conference on Algal Biomass, Biofuels and Bioproducts, June 11 - 13, 2018, Seattle, WA.
16. **Mohana Rangan S**, Mouti A, Delgado AG, Krajmalnik-Brown R, Lowry GV, LaPat-Polasko L, Brenton H. Trade-offs in utilizing zero-valent iron for synergistic biotic and abiotic reduction of trichloroethene and perchlorate. Battelle Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Palm Springs, CA, April 2018. (Poster presentation) .
17. **Mohana Rangan**, **S.,** A. Mouti, A.G. Delgado, R. Krajmalnik-Brown, G.V. Lowry, L. LaPat-Polasko, and H. Brenton. Trade-Offs in Utilizing Zero-Valent Iron for Synergistic Biotic and Abiotic Reduction of Trichloroethene and Perchlorate. Srivatsan Mohana Rangan (Arizona State University/USA). Battelle 2018. Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Palm Spring California. April 2018.
18. O’Donnell, S., **Hall, C.**, Kavazanjian, E. and Rittmann B.E. *A Biogeochemical Model for Soil Improvement by Denitrification*.
19. **Peraza,I.** Presented a talk titled: Mathematical modeling of electroactive biofilms at the first meeting of CONACYT fellowships in United States in Washington DC from 15 to 17 of March.
20. **Peraza,I.** Taught the workshop: *Mathematical Modeling in Environmental Engineering with MATLAB* to Environmental Engineering Graduate Students at the Engineering department at the Yucatan State University
21. **Peraza,I.** Gave a talk at the Technological Institute of Merida, Yucatan, Mexico for Environmental and Chemical engineering bachelor Student about his personal journey as a scientist
22. **Peraza,I.** Gave a talk at the Technological Institute of Merida, Yucatan, Mexico for Environmental and Chemical engineering bachelor Student about his personal journey as a scientist.
23. **Ray, H**., Boyer, T.H., Perreault, F. Urea Recovery from Source Separated Urine by Forward Osmosis and Membrane Distillation. Talk presented at AZ Water 91st Annual Conference: Phoenix, AZ, May 4, 2018.
24. **Ray, H.,** Boyer, T.H., Perreault, F. Urea Recovery from Source Separated Urine by Forward Osmosis and Membrane Distillation. Poster presented at: ASU SSEBE Graduate Poster Competition: Tempe, Arizona, 16 February 2018.
25. **Ray, H.,** Boyer, T.H., Urea Recovery from Source Separated Urine by Membrane Processes. Poster presented at: AZ Water Research Committee Annual Workshop: Tempe, Arizona, 9 January 2018.
26. **Reynolds, M.C,** Krajmalnik-Brown, R., & Cadillo-Quiroz, H. "Intra-microbial community variation exists within a single municipal solid waste landfill." American Society of Microbiology (ASM), Arizona/Southern Nevada Branch Meeting 2018. Poster
27. **Robles, Aide**. "Reductive Dechlorination of Trichloroethene(TCE) Sustained by Microbial Chain Elongation" at ASU FURI Symposium.

28. **Rittmann, B.E.** Invited lecture, "Including Biofilm Detachment in Models. NSF-sponsored workshop on Mechanical Properties of Biofilms," University of Notre Dame, South Bend, IN. April 23, 2018.
29. **Rittmann, B.E.** Invited lecture, "Microbial Products in Environmental Biotechnologies," Tongji University, Shanghai, PRC. May 22, 2018.
30. **Rittmann, B.E.** Invited lecture, "Biofilm Processes," Shanghai Normal University, Shanghai, PRC. May 23, 2018.
31. **Rittmann, B.E.** Invited lecture, "Activated Sludge," Tongji University, Shanghai, PRC. May 24, 2018.
32. **Rittmann, B.E.** Invited lecture, "Biofilm Processes in Drinking Water Treatment," Hohai University, Nanjing, PRC. May 31, 2018.
33. **Rittmann, B.E.** Invited lecture, "Microbial Photobioenergy – Making CO_2 a Resource, Not a Liability," Dalian University of Technology, Dalian, PRC. June 1, 2018.
34. **Rittmann, B.E.** Invited lecture, "The Hydrogen-based Membrane Biofilm Reactor (MBfR) for Reducing Oxidized Contaminants," Dalian University of Techology, Dalian, PRC. June 2, 2018.
35. **Rittmann, B.E.,** Krajmalnik-Brown, R., Kang, D., Ilhan, Z.E., Marcus, A.K., DiBaise, J., Isern, N.G., Invited lecture, "Roux-en-Y Gastric Bypass Surgery Shifts Gut Microbial Communities and Associated Metabolites," Sichuan University, Chengdu, PRC. June 5, 2018.
36. **Rittmann, B.E.** Invited lecture, "Being Productive," Druid Technologies, Chengdu, PRC. June 6, 2018.
37. **Rittmann, B.E.** Invited lecture, "The Hydrogen-based Membrane Biofilm Reactor for Reducing Oxidized Contaminants," Suzhou University of Science & Technology, Suzhou, PRC. June 7, 2018.
38. **Rittmann, B.E**., Krajmalnik-Brown, R., Kang, D., Ilhan, Z.E., Marcus, A.K., DiBaise, J., Isern, N.G., Invited lecture, "Roux-en-Y Gastric Bypass Surgery Shifts Gut Microbial Communities and Associated Metabolites," Soochow University, Suzhou, PRC. June 8, 2018.
39. **Rittmann, B.E.** Invited lecture, "The Hydrogen-based Membrane Biofilm Reactor for Reducing Oxidized Contaminants," Hong Kong University, Hong Kong. June 27, 2018.
40. **Rittmann, B.E.** Invited lecture, "Microbial Products in Environmental Biotechnologies," Hong Kong University of Science & Technology, Hong Kong. June 28, 2018.
41. **Rittmann, B.E.** Invited lecture, "The Big Picture of Energy Options," WiseGuise, Scottesdale, AZ. Feb 16, 2018.
42. **Rittmann, B.E.** Invited lecture, "Environmental Biotechnology, Partnering with Microorganisms," Engineers Week Event on Engineering in Practice, ASU. Feb 19, 2018.
43. **Rittmann, B.E.** Invited lecture, "Partnering with Microorganisms to Turn Pollution into Value," Biodesign Open Door, ASU. Feb 24, 2018.
44. **Rittmann, B.E.** Invited lecture, "The Microorganisms Always Close the Mass Balance," Center for Bio-inspired and Bio-mediated Geotechnics Webinar, ASU. Mar 2, 2018.
45. **Wilson, C.**, Hart, S., Brown, S., Young, M., Ki, D., Torres, C.I. "Microbial Electrochemical Cells as An Alternative to Biochemical Methane Potential Tests for Analyzing Batch Anaerobic Digestion Kinetics" for the WEF Residuals and Biosolids, Phoenix, AZ, 2018.
46. **Zeng, C.** "Enhancing the Biodegradation of Heavy-Hydrocarbons in Soil" HHSRG year-end Meeting, 2018. Houston, TX.
47. **Zhou, C.** and Bruce E. Rittmann. "Biorecovery of Precious Metal from Waste Streams: Biofilm Enhanced Nanoparticle Synthesis and Beyond" for the 2018 IWA LET conference in Nanjing, China (poster)

Mentoring activities

Degrees conferred

Ph.D.

1. Avni Solanki, Treavor Boyer advisor, Ph.D. in Environmental Engineering from University of Florida, Dissertation: *Investigation of Pharmaceutical Removal in Source Separated Urine Using Biochar*, May 2018
2. Tengfei Chen, Bruce Rittmann advisor, Ph.D. in Civil, Environmental and Sustainable Engineering from the School of Sustainable Engineering and the Built Environment, Dissertation*: Applying Ozone to Enhance Bioremediation of Petroleum-contaminated Soils*, June 2018.

Masters

1. Sayalee Joshi, Anca Delgado advisor, MS in Chemical Engineering from the School for Engineering of Matter, Transport and Energy, Thesis: Microbial Metabolic Chain Elongation, May 2018

Undergraduate

1. Omar Arafa, BS Chemical Engineering, *Mass Transfer Kinetics of Novel Asymmetric Hollow-fiber Membranes* (Barrett the Honors College), May 2018
2. Patricia Ibalo, BS Molecular Biosciences and Biotechnology, May 2018
3. Lidia Peon, BS Biological Sciences, May 2018
4. Ben Wik, BS Chemical Engineering, Sustainability Minor, *Exploring the consequences of permeate recycling in a photobioreactor using multi-component, community-level modelling* (Barrett the Honors College), May 2018

Mentoring relationships

Ph.D.

Megan Altizer (Krajmalnik-Brown, Torres)
Steffen Buessecker (Cadillo Quiroz)
Diana Calvo Martinez (Rittmann)
Neng Iong Chan (Rittmann)
Tengfei Chen (Rittmann)
Taylor Davis (Rittmann)
Blake Dirks (Krajmalnik-Brown)
Sofia Esquivel Elizondo (Krajmalnik-Brown)
Caitlyn Hall (Rittmann)
Steven Hart (Torres)
Ethan Howley (Krajmalnik-Brown, Torres)
Neha Jagtap (Boyer)
Justin Kidd (Krajmalnik-Brown)
Christine Lewis (Torres)
Yuanzhe Liu (Lai, Rittmann)
Yihao Luo (Rittmann)
Evelyn Miranda (Delgado, Lai)
Srivatsan Mohana Rangan (Delgado, Krajmalnik-Brown)
Isaias Peraza (Rittmann)
Erik Poppleton (Delgado)
Hannah Ray (Boyer)
Mark Reynolds (Cadillo-Quiroz, Krajmalnik-Brown)
Rain Richards (Boyer)
Daniella Saetta (Boyer)
Analissa Sarno (Cadillo Quiroz)
Avni Solanki (Boyer)
Thiago Stangherlin Barbosa (Eustance, Lai, Rittmann)
Levi Straka (Rittmann)
Burcu Yavuz (Rittmann)
Michelle Young (Rittmann)
Julian Yu (Cadillo Quiroz)

Masters

Francisco Brown-Munoz (Torres)
Gururaj Daptardar (Rittmann, Eustance, Lai)
Rebecca Dietz (Boyer, Saetta)
Rick Kupferer (Torres, Ki)
Sayalee Joshi (Delgado)
Zeni Ramirez (Cadillo Quiroz)
Shefali Rao (Delgado and Krajmalnik-Brown)
Urusha Regmi (Boyer)
Aide Robles (Delgado)
Tarun Shesh (Rittmann, Eustance, Lai)
Wenxia Xu (Krajmalnik-Brown, Zeng)
Chenwei Zheng (Rittmann, Zhou)

Post-Doctoral Researchers

Everett Eustance (Rittmann)
Dongwon Ki (Torres)
Outi Lähteenoja (Cadillo Quiroz)
Chao Zeng (Krajmalnik-Brown)

Research Scientists

Daewook Kang (Krajmalnik-Brown)
Yen-Jung Lai (Rittmann)
Chen Zhou (Rittmann)

Undergraduates

Ana Aragon-Sierra (Krajmalnik-Brown, Kang)
Omar Arafa (Rittmann, Calvo Martinez),FURI
Jordan Canning (Cadillo Quiroz)
Debbie Chang (Dirks, Krajmalnik-Brown)
Sheridan Davis (Boyer, Solanki, Saetta)
Alex Drew (Cadillo Quiroz)
Angela Egan (Boyer, Ray, Saetta)
Fred Elick (Cadillo Quiroz)
Sam Greenberg (Boyer, Ray)
Savannah Hull (Rittmann, Barbosa)
Patricia Ibalo (Torres, Howley)
Ibrahim Ibrahim (Delgado, Mohana Rangan)
Brielle Januszewski (Rittmann, Chen), FURI
Evan Jones (Rittmann, Lai)
Nikita Kowal (Boyer, Saetta)
Raja Mabry (Delgado, Robles)
Jade Martinez (Boyer, Ray)
Lincoln Mtemeri (Torres, Ki)
Jigar Patel (Krajmalnik-Brown, Kang)
Lidea Peon (Torres, Howley)
Neil Rastogi (Rittmann, Liu), FURI
Andrea Russell (Torres, Brown-Munoz)
Riley Tesman (Boyer, Solanki)
Ben Wik (Marcus)
Collette Wilson (Torres, Hart)
Theodora Yellowman (Delgado)
Kai Yin (Marcus, Papacharalampos)
Diana Zermeno (Torres)

High School Students

Samihan Dani (Rittmann, Eustance, Lai), Hamilton High School
Leila Kahn (Krajmalnik-Brown, Zeng), Scottsdale Preparatory Academy
Lily Mobasher (Rittmann, Calvo Martinez), Basis Phoenix

Teachers

Allison McCaw, Mtn View HS (Rittmann, Lai)

Volunteers

Chris Connot (Krajmalnik-Brown, Kang)
Yesenia Moreno Caro (Krajmalnik-Brown, Kang)

Brad Lusk (Rittmann, Zhou)

Staff

Sarah Arrowsmith (Krajmalnik-Brown)
Chris Connot (Krajmalnik-Brown)
Carole Flores (Rittmann)
Garrett Montoya (Rittmann, Yavuz)
Carlos Leyva (Boyer)
Yesenia Moreno Caro (Krajmalnik-Brown)
Jigar Patel (Krajmalnik-Brown)
Matt Scholz PhD (Rittmann)
Rob Stirling (Rittmann)

Visiting scholars

(Mentors in parentheses)

1. Melanie Hekeu, PhD student from Marche Polytechnic University, Italy (Rittmann, Yavuz)
2. Min Long, PhD student from the College of Environmental Science and Engineering, Tongji University (Rittmann, Zhou)
3. Kun Zhang PhD, College of Power and Energy Engineering, Harbin Engineering University (Rittmann, Lai)
4. Xiong Zheng PhD, College of Environmental Science and Engineering, Tongji University (Rittmann, Zhou)
5. Nianbing Zhong PhD, College of Optical and Electronic Technology, Chongqing University of Technology (Rittmann, Zhou)

Special activities

We launched our re-designed website: environmentalbiotechnology.org.

Anca Delgado, Treavor Boyer. Core Committee Member of 2019 Association of Environmental Engineering and Science Professors (AEESP) Research and Education Conference, Tempe, AZ, May 2019

Sarah Arrowsmith and Everett Eustance, Compliance Officers

Open Door: Dongwon Ki (exhibit leader), Sean Lai, Hannah Ray, Everett Eustance (exhibit leader), Megan Altizer (exhibit leader), Blake Dirks (exhibit leader), Taylor Davis, Francisco Brown Munoz, Min Long, Carole Flores (Biodesign Open Door Committee), Urusha Regmi, Neha Javadi, Daniella Saetta, Angela Egan, Nikita Kowal, Sheridan Davis, Shefali Rao, Sayalee Joshi, Carlos Leyva

Megan Altizer

- Partnership with Geosyntec on researching electrokinetic bioremediation

Francisco Brown-Munoz

- Toured 21 English and math teachers visiting ASU as part of a training program from Saudi Arabia, June 26
- Taught the Introduction to Engineering 10th grade class for the Barrett Summer Scholars summer program. https://eoss.asu.edu/bss
- Noche de Ciencias (STEM) Night at Phoenix Coding Academy (February 23, 2018) and Western Valley Middle School (March 23, 2018) as part of the Society of Hispanic Professional Engineers (SHPE) at ASU outreach. Presented 3 on-site STEM challenges to 6-12th grade students and hosted a bilingual parent workshop titled "Helping Your Child on Their Journey to College". http://www.shpedeasu.org/
- Hosted a panel about college life and pursuing an engineering career for sophomores, juniors, and senior of the CompuPower Summer Program as part of the Society of Hispanic Professional Engineers, ASU chapter.
- Helped presenting a tour for local middle school students to The Biodesign Institute and BSCEB to motivate students to pursue a career in engineering.
- Lead and organized a tour of Biodesign Swette Center for Environmental Biotechnology for 17 students as part of the Introduction to Engineering 10th grade class of the Barrett Summer Scholars summer program. https://eoss.asu.edu/bss
- Active member of the Society of Water and Environmental Leaders. https://fso.engineering.asu.edu/project/society-of-water-and-environmental-leaders-swel-2/

Diana Calvo

- Starting collaborations with Universidad de los Andes for possible future projects.

Neng Iong Chan

- 2018 May Joint FAO/IAEA programme intern, Soil and Water Management & Crop Nutrition Section, United Nations Food and Agriculture Organization/International Atomic Energy Agency, Vienna, Austria

Taylor Davis

- Volunteered for SEMTE's open house for potential chemical engineering doctorate students

Everett Eustance

- Track Chair for upcoming Algae Biomass Summit 2018

Caitlyn Hall

- California Environmental Protection Agency Hazard Resilience Presentation, *Presenter*
- City of Vancouver Resilience Meeting, *Presenter*
- National Environmental Protection Agency Hazard Resilience Presentation, *Presenter*
- Association for Environmental and Engineering Geologists Chapter Meeting, *Presenter*
- NSF National I-Corps Program, NSF

- AAAS Catalyzing Advocacy in Science and Engineering Workshop, AAAS
- European Geosciences Union Young Hydrologic Society, *Board Member*
- American Geophysical Union Hydrology Section Student Subcommittee, *Vice Chair*
- National Science Policy Network, *Member*
- ASU Arizona Science Policy Network, *Founder*
- Graduate Students for the Environment, *Vice President*
- CBBG Student Leadership Council, *President*

Steven Hart
- Student Coordinator, Prison Biology Education Program. Myself along with Ethan Howley and Blake Dirks helped teach an introductory biology course at the Rynning Unit of the Eyman state prison complex in Florence, AZ.

Ethan Howley
- BioSciences Core Governance Board Student Representative

Dongwon Ki
- Night of the Open Doors, Leader for coordinating Center's activities, Biodesign Institute, ASU, Feb, 2018
- Active reviewer for the following journals: Scientific Reports, Separation Science and Technology, Water Research, Environmental Engineering Science

Rosa Krajmalnik-Brown, Blake, Dirks, Taylor Davis
- Translational Research Institute for Metabolism and Diabetes collaboration, visit to Orlando, FL to meet with collaborators and tour facilities in May, 2018. Participants explored the Life of a Patient, Mathematical Modeling, Methane and Hydrogen Measurements, as well as discussed publications.

Rosa Krajmalnik-Brown
- National Academies of Science, Engineering, and Medicine Committee on Advancing Understanding of the Implications of Environmental-ChemicalInteractions with the Human Microbiomes

Yen-Jung (Sean) Lai
- Poster Section reviewer for upcoming Algae Biomass Summit 2018

Evelyn Miranda
- Western Alliance to Expand Student Opportunities workshop about grants and where the money comes from

Isa Peraza

- As part of a Climate Change course he took this Spring, Isa wrote a research paper tittled: The different theories to explain the great Maya collapse influenced by climatic events. Isa is from the Yucatan, is a Mayan scholar, and teaches about the Mayan language.
- Collaborated to create a curriculum for a summer class in fundamental of scientific research in the natural sciences a class planned to high School students that are a subsection of the Yucatan State University

Hannah Ray

- Secretary for the Graduate Students for the Environment (GSE), February–Present
- Scottsdale Community College student tours, March 8, 2018

Matthew Reynolds

- Center for Bio-mediated and Bio-inspired Geotechnics at Capitol Elementary Schools's End of the Year Science Fair.

Bruce Rittmann

- Fellows Steering Committee, Association of Environmental Engineering and Science Professors

Matthew Scholz

- The Swette Center continues to provide infrastructure support to the Sustainable Phosphorus Alliance, an organization that functions as an industry nonprofit that promotes the sustainable use, recovery, and recycling of phosphorus in the food system. Leveraging that support, the Alliance hosted its second annual Phosphorus Forum event on the Tempe campus on February 26th, attracting some 60 participants, mostly from industries across the US and Canada. The event brought these participants from across the phosphorus value chain together for knowledge sharing and networking. Video footage of the day's events is available at https://youtu.be/8A9NFkSwji8.

Chen Zhou

- Traveled in China for assisting Bruce to establish collaboration with **Chinese governments and universities**.
- Promoting technology transfer for **Precient Technology, LLC**., a company co-founded by Bruce and me and others.

Awards and accolades

(alphabetical by person after Fulton Schools of Engineering Dean's Fellows)

- Fulton Schools of Engineering Dean's Fellows:
  a. Megan Altizer (SSEBE)
  b. Taylor Davis (SEMTE)
  c. Caitlyn Hall (SSEBE)
  d. Ethan Howley (SSEBE)
  e. Burcu Yavuz (SSEBE)

- Diana Calvo Martinez
    a. GPSA Travel Grant Fellowship for $950
    b. GPSA Kick-starter Grant for $500

- Neng Iong Chan
    a. 2018 Feb Graduate College Travel Award ($500)
    b. 2018 Feb Career Development Grant, Graduate and Professional Student Association (GPSA) ($550)
    c. 2018 Feb Travel Award, School of Life Sciences ($400)

- Hannah Ray
    a. NSF Graduate Research Fellowship Program 2018 Honorable Mention
    b. 1st Place AZ Water Research Committee Annual Workshop Poster Competition

- Mark Reynolds
    a. Best Graduate Student poster (Runner up) - American Society of Microbiology (ASM), Arizona/Southern Nevada Branch Meeting (3/2018)

- Bruce Rittmann. Stockholm Water Prize

- Aide Robles. Environmental Engineering M.S., Master's Opportunity in Research Engineering (MORE) awardee, Spring2018, Fall 2018.

- Chen Zhou, I won the 2nd prize of The Entrepreneurship Competition held by the Zhangjiagang government in Beijing, China ($3,000 equivalent)

making an impact

Semi-annual Impact Report

Swette Strategic Investment Fund

July 2018 – December 2018

Prepared by Bruce E. Rittmann
Director and Regents' Professor

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

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 2018 continued the strong momentum for the Biodesign Swette Center for Environmental Biotechnology. This report highlights key advances that are paving the way for greater discoveries in 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 not only to attract the best and the brightest, but 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. We have over $5.3 million in funding from NIH, DoD, and Finch Therapeutics to explore different aspects of understanding and managing the intestinal microbiome.

- We also invested in our microbial photobioenergy team. We just finished a $1-million grant from the Department of Energy and were awarded a new $1.9 DoE grant to follow up on our work on delivering CO_2 to improve microalgae productivity.

- The Swette investment also has allowed us to play major roles in two NSF-sponsored Engineering Research Centers: The Center for Bio-Inspired, Bio-mediated Geotechnics (CBBG) and Nano-enabled Water Treatment (NEWT). Each Engineering Research Center has research support of around $40 million over ten years

- The Swette Center also is taking leadership roles in major international collaborations in China, Morocco, Mexico, and Israel.

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.

How do we measure success?

The Swette Center is a major international player in the search for new ways to create a more sustainable human society. Our research, technologies, and people are the driving forces for improving environmental quality, creating truly renewable resources, and helping humans be healthier. How do we know that we are having a positive impact?

On the ground, our work is leading to technological advances that are helping society move towards better sustainability. For example, Swette Center research has established that fecal transplants can help those in the autism spectrum interact better with their families and colleagues—preliminary findings that are clearly of interest to a world and a nation where one in 68 children has an autism spectrum disorder. The U.S. alone saw a 30 percent increase from 2012 to 2014, as reported by the Centers for Disease Control and Prevention.

We were also able to demonstrate that our membrane biofilm reactor can convert toxic metals in mining wastewaters into highly valuable nanoparticles. We started a spin-off company to commercialize this exciting advance. And, we are scaling up microbial electrochemical cells to provide energy-neutral wastewater treatment for groups of 50 to 500 people in remote areas.

Our work is adding to an important body of knowledge in the field of environmental biotechnology. Some of the impacts occur primarily within the academia and are readily tabulated. For example, we **published 40 papers**, received **8 additional research grants** in the past six months bringing our total to **32 ongoing research programs**, and **garnered 11 awards** over the past six months. We are proud of our long list of alumni who are leading the field and inspiring the next generation of environmental scientists.

Within ASU, Dr. Rosa Krajmalnik-Brown was promoted to Full Professor in the School of Sustainable Engineering and the Built Environment, and Dr. Hinsby Cadillo-Quiroz was promoted to Associate Professor with tenure in the School of Life Sciences.

OUR PEOPLE

Celebrating world-wide recognition of environmental research promise

Stockholm Water Prize Award Ceremony and World Water Week

In August, Professors Bruce Rittmann and Mark van Loosdrecht received the 2018 Stockholm Water Prize in Sweden for microbiological research and innovations that have revolutionized water and wastewater treatment. #WWWeek. Full article.

A delegation from Arizona State University – including John Sabo, Dragan Boscovic, Vesna Boscovic, Li Huang, Obiageli Sneed, Leah Jones, Treavor Boyer, LaDawn Haglund, Daniella Saetta, and Netra Chhetri (pictured) – participated in the Stockholm World Water Week and attended the Stockholm Water Prize award ceremony. Read the Future H2O newsletter for details and testimonials from students Daniella Saetta and Leah Jones.

Bruce Rittmann and Mark van Loosdrecht talk about their plans for building understanding about water treatment and express their optimism for the future of their field and their collaborations in SIWI's *WaterFront Daily #4 2018,* in an article titled "Curiosity-charged laureates look ahead to new challenges." Full article here.

Hinsby Cadillo-Quiroz receives NSF CAREER Award to Study Greenhouse Gases

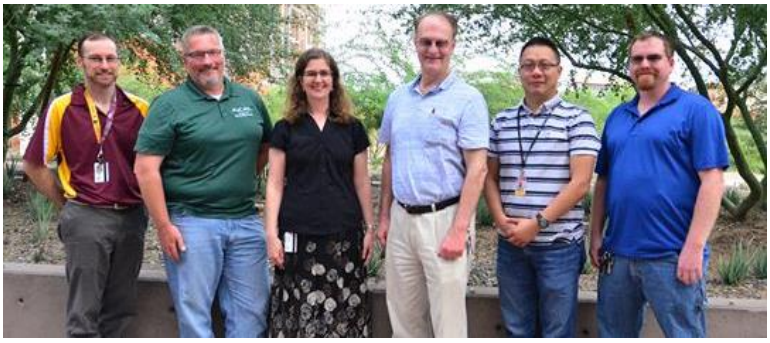
Hinsby Cadillo-Quiroz, microbiologist and associate professor with Arizona State University's School of Life Sciences and the Biodesign Swette Center for Environmental Biotechnology, has been awarded a prestigious 5-year, $650,000+ National Science Foundation (NSF) CAREER Award for his work exploring connections between microbes and components within Peruvian Amazonian peatland ecosystems that affect the consumption and production of methane gas. Cadillo-Quiroz and his international team that

includes researchers from Arizona State University, the Universidad de la Amazonia Peruan, and Centro de Investigaciones de Recursos Naturales de la Amazonia Peruana (CIRNA, UNAP) are using a portable gas analyzer that can detect nearly 200 different gases emitted from the peatlands. They are also characterizing microbes that live both inside and outside of the ecosystems, to determine what roles microbes play in the absorption or release of greenhouse gases.

Anca Delgado is a Semi-Finalist to receive Women & Philanthropy Award.

Delegates from Women & Philanthropy visited ASU in October to learn about Dr. Delgado's proposal to develop a research-based course "Tempe Town Lake: Ecosystem of a Desert Oasis in an Urban Environment." She will learn if she is to receive the award in early 2019.

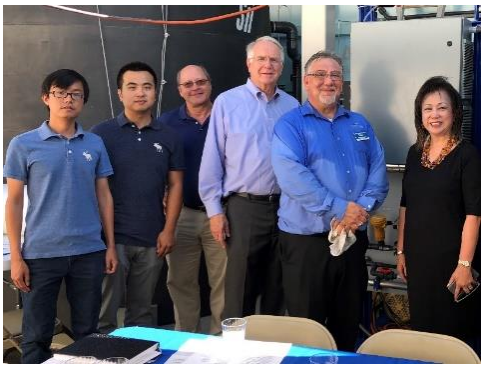
Swette Center Receives DOE Grant



The DOE awards $4.5 million to ASU researchers to discover new ways to harness carbon dioxide for reducing biofuel costs. The U.S. Department of Energy has announced projects that have been awarded $80 mil to support early-stage bioenergy research. Two ASU teams from ASU Biodesign Institute Swette Center for Environmental Biotechnology and ASU School of Life Sciences are among the grantees, with the grants totaling $4.5 million.

Drs. Rittmann, Zhou, and Zheng Celebrate Reactivation of MBfR-Based Well

On Thursday, July 26, 2018, the Crescenta Valley Water District, in California, reactivated a well that deploys a hydrogen-based membrane biofilm reactor (MBfR) to extract nitrate contamination from groundwater. Read the full article, written by Mary O'Keefe, in the *Cresenta Valley Weekly, the Foothills Community Newspaper*. Drs. Chen Zhou and Xiong Zheng attended the ceremony on behalf of MBfR-inventor Dr. Rittmann, both of whom are referenced in the article. *Crescenta Valley Weekly*, the local newspaper, interviewed Dr. Zhou and reported this exciting milestone in reviving the well as an important source to provide local residents with clean and safe drinking water.



(From left to right) Dr. Xiong Zheng, Dr. Chen Zhou, David Friese (Sr. Engineer at APTwater), Terry Applebury (GM of APTwater), David Gould (District Engineer in CVWD), Margaret Wong (President of McWong Environmental Energy Group)

Treavor Boyer organizes 2019 AEESP Research and Education Conference

This event will attract 600 to 800 mostly faculty and graduate students from Environmental Engineering and Environmental Science programs across the US. Here is the conference website https://aeesp-2019.engineering.asu.edu/.

AEESP | Association of Environmental Engineering & Science Professors
1963-2013: Celebrating 50 Years of Advancing Environmental Engineering & Science

The Sustainable Phosphorus Alliance has announced that Kathleen Merrigan and Bruce Rittmann will be the keynote speakers at Phosphorus Forum 2019, scheduled for April 5, 2019, in Washington, D.C.

On November 21, 2018, the Julie Ann Wrigley Global Institute of Sustainability announced that Biodesign Swette Center for Environmental Biotechnology Director and Stockholm Water Prize co-Recipient Bruce Rittmann will be one of the keynote speakers at Phosphorus Forum 2019. The **Phosphorus Forum** is an annual conference organized by the Sustainable Phosphorus Alliance, a nonprofit membership organization addressing the complex problem of phosphorus sustainability. Phosphorus Forum 2019 will be an opportunity for organizations and professionals to network and learn about innovations in sustainable use, recovery and recycling of phosphorus. Read more information and register on the Phosphorus Forum website

César Torres attends the 1st Western States Chemical Engineering Heads/Chairs Meeting.

Dr. César Torres attended as a representative of Arizona State University's Chemical Engineering program. Hosted by the University of New Mexico, the goal was to assess programs against ABET criteria, share best practices, develop a strong culture of safety, alumni engagement, recruiting, professional ethics, as well as increased graduation rates, effective budget management, and curriculum development.

Vladimir Alvarado (Wyoming), Abhaya Datye (New Mexico), Sindee Simon (Texas Tech), Brian Grady (Oklahoma), David Rockstraw (New Mexico State), David Dandy (Colorado State), Roland Faller (California-Davis), Cesar Torres (Arizona State), Thomas Ho (Lamar), Rob Whitely (Oklahoma State)

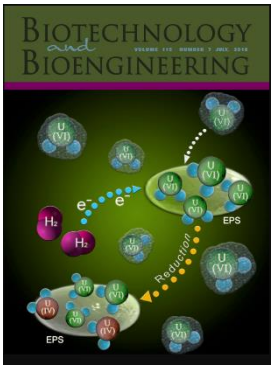
The following section documents the Center's achievements in these categories:

- **Research Activities and Outputs**
- **Mentoring Activities**
- **Special Activities and Impacts**
- **Awards and Accolades**
- **Alumni Success**

2018 HIGHLIGHTS

Research activities and outputs, January – June 2018

40 publications and media, with 8 high-profile examples



Back-to-back discoveries by ASU Biodesign Institute research scientist Chen Zhou and his team graced the covers of the July and August issues of "Biotechnology and Bioengineering," a leading journal in the biotech field. Full article.

ASU's *Ask a Biologist* website features science articles, activities, games, interviews, podcasts and so much more that make science accessible and exciting for students, teachers, and the general public. The website recently published an article called *Mending with Microbes* that describes the good things that microbes do for us and how people partner with them to make the world a healthier place. Our own Dr. Rosy's career path is highlighted in the article! Students and teachers from around the world will use this information in their exploration of biology and related careers.

The article "Gut 'bug' transplants can bring kids with autism lasting benefits; these fecal transplants improved both behavioral problems and tummy troubles," featured in the August 24, 2018 edition of *Science News for Students*, explains autism, clinical trials, and how the Krajmalnik-Brown Lab and collaborators found that good microbes help to alleviate gastrointestinal and behavioral symptoms in children who suffer from Autism Spectrum Disorder.

Swette Center alumna Dr. Brooke Mayer of Marquette University discusses her Environmental Science & Technology paper, entitled "Managing Diffuse Phosphorus at the Source versus at the Sink", with Dr. Matt Scholz of the Sustainable Phosphorus Alliance on YouTube. Listen here. Co-authors include Dr. Katrina Macintosh of Queen's University of Belfast, Prof. Rich McDowell of AgResearch and Lincoln University, Dr. Stephen Powers of Washington State University, Dr. Lawrence Baker of University of Minnesota, Dr. Treavor Boyer of Arizona State University, and Dr. Bruce Rittmann of Arizona State University.

Swette Center PhD student Caitlyn Hall and three colleagues wrote a blog post "The Elephant in the Lab: Five Sustainable Ways to Engage in Science Policy" that was featured yesterday, 10/10/2018, in the American Geophysical Union blog site *The Bridge*.

> *Authorship of this guest post is credited to Jeremy Spool – post-doctoral researcher at University of Massachusetts at Amherst, Caitlyn Hall – Ph.D. student in Environmental Engineering at Arizona State University, Jeff Brookins – Ph.D. student in Materials Science and Engineering at University of Tennessee, Knoxville and Oak Ridge National Laboratory, and Brian Canter – Ph.D. student in Biomedical Engineering at Rutgers University. They attended the AAAS Catalyzing Advocacy in Science and Engineering workshop this past March.*

Swette Center PhD student Isa Peraza hosted a screening of *Secos*, a 20-minute documentary from Sergio Cobos; Aurelio Mugarte, Alfonso Uicab and Rodrigo Llanes in the Biodesign Institute auditorium on Monday October 15th from 5:00 to 6:00 pm.

SYNOPSIS

Since the cloudy approval of a photovoltaic park project at the edge of their hometown San José Tipceh, mayan "ejidatarios" Aurelio and Alfonso can't help to think of the environmental and social risks that would come along with the implementation of more than a million solar panels at a few hundred meters from their homes. Worried about the lack of explanations they exercise their right to be properly informed and consulted, as the law mandates for the indigenous people in Mexico. They strive to make their voices heard and to have concerns taken into account, which soon seems an impossible task as both federal government and corporations keep pushing the project forward.

*Ejidatarios: Land owners of rural common lands

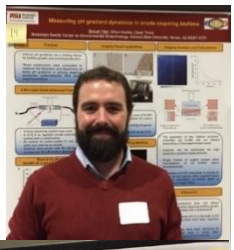
The Sustainable Phosphorus Alliance also produced a live webinar for its Sustainable Phosphorus Webinar Series on its ongoing work on biosolids and manure land application regulations, available here: https://youtu.be/Obub_VsvnzU.

The Sustainable Phosphorus Alliance launched a new video series called Phosphorus Science Now. The series produces publically available video abstracts of research papers recently released on topics relevant to phosphorus sustainability: https://youtu.be/S3vUWbTjuyk. Interviews with authors from two new papers were provided over this reporting period as a resource to other researchers who seek to stay on top of cutting-edge sustainability research.

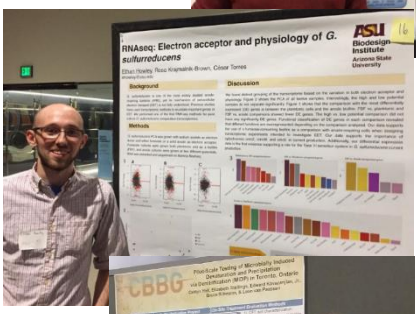
Anca Delgado and Aide Robles were featured on the cover of the *Center for Bio-mediated & Bio-inspired Geotechnics* (CBBG) 2018 report to the National Science Foundation as well as in the *ASU FURI/MORE Fall 2018 symposium handbook*.

42 presentations at conferences, universities, and other research laboratories, and four examples

Steven Hart and Ethan Howley presented posters at at NA-ISMET meeting presenting research in October. titled, "Measuring pH gradient dynamics inside anode respiring biofilms" at the North American meeting of the International Society for Microbial Electrochemistry and Technologies.

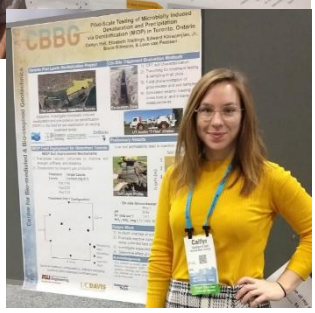


Hart S and **Torres CI** "Measuring pH gradient dynamics inside anode respiring biofilms" at the North American meeting of the International Society for Microbial Electrochemistry and Technologies, October 2018.

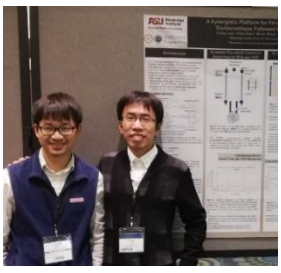


Howley E and **Torres CI** RNAseq: Electron acceptor and physiology of G. sulfurreducens. North American International Society for Microbial Electrochemistry and Technology meeting, October 2018.

Caitlyn Hall who presented her work at the American Geophysical Union Fall Meeting



Hall CA, Stallings E, Kavazanjian E, **Rittmann BE**, and van Paassen L. Pilot-Scale Testing of Microbially Induced Denitrification (MIDP) in Toronto, Ontario.



Yihao Luo represented Dr. Rittmann at the 2018 SERDP & ESTCP Symposium in Washington D.C.

Luo Y, **Zhou C**, Wang B, **Krajmalnik-Brown R**, **Tang Y** and **Rittmann BE**. A Synergistic Platform for Pd-catalytic Reduction of 1,1,1-Trichloroethane and Trichloroethene Followed by Biological Co-metabolism of 1,4-Dioxane. SERDP & ESTCP Symposium, Washington D.C., November 2018.

1 patent application pending and 1 disclosed.

32 externally funded research projects from **21** U.S. federal agencies (National Science Foundation, National Institutes of Health, Department of Energy, Department of Defense, and NASA)
Other funders included foundations, industries, and foreign agencies.

Mentoring activities

- **9** degrees earned: **1** PhD, **7** Masters, and **1** Bachelors
- **41** graduate students, **4** post-doctoral associates, and **3** research scientists
- **27** undergraduates, including **1** Swette Undergraduate Sustainability Intern and **3** Fulton Undergraduate Research Initiative Scholars
- **13** visiting scholars
- **2** high school students and **1** high school teacher
- **1** volunteer researcher

Special activities – highlights (see appendix for comprehensive list)

- **Neng Iong Chan**, PhD student in Environmental Life Sciences, spent six months as an intern in the Soil and Water Management & Crop Nutrition Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, in Vienna, Austria.
- **Steven Hart and Ethan Howley**, PhD students in Environmental Engineering, led a teaching workshop for staff teachers in Perryville Women's Prison.
- **Caitlyn Hall and Ethan Howley**, PhD students in Environmental Engineering, founded, developed, and instructed *Science Policy for Scientists and Engineers*, a 2-semester course.
- **Isa Peraza**, PhD student in Environmental Engineering, taught a workshop*: Mathematical Modeling in Environmental Engineering with MATLAB to Environmental Engineering Graduate Students* at the Engineering department at the Yucatan State University in May of 2018.
- **Matthew Scholz**, director of the Sustainable Phosphorus Alliance, is organizing the 2109 Sustainable Phosphorus Workshop to be held in April in Washington, DC. Dr. Rittmann will be one of the keynote speakers.

Awards and accolades – highlights (see appendix for comprehensive list)

12 awards to **14** individuals, including:

- **5** Dean's Fellowships from the Fulton Schools of Engineering
- **1** best-presentation winner
- **2** travel grants
- **1** Stockholm Water Prize!

Alumni success

A measure of our alumni success is the number of PhD and post-doc alumni who are now tenured or tenure-track professors at major universities around the world. These include:

- Alumna **Rachel Yoho** named to Fulbright Specialist Roster, full article
- **Dongwon Ki** has accepted a postdoc position at the University of Illinois at Urbana-Champaign starting in January of 2019.
- **Daewook Kang** PhD has accepted an Assistant Professor position at the University of Toledo starting in January of 2019.
- Alumnus **Fatih Karadagli** was invited to present his work on flushables to the Japan Sewage Works Agency in January.
- **Tengfei Chen** was hired by GeoSyntech.
- **Levi Straka** was hired by the Metropolitan Water Reclamation District of Greater Chicago.
- **Avni Solanki,** lecturer, Washington University in St. Louis
- Sharad Kumar Vellore Suresh - Process Development Associate - Conagen Inc.
- Dongwon Ki - Postdoctoral Researcher - University of Illinois - Urbana-Champaign
- Sudeep Popat - Assistant Professor - Clemson University
- Rachel Yoho - Visiting Assistant Professor - Miami University
- Bradley Lusk - Research Fellow - US Naval Research Laboratory
- Joseph Miceli - Project Coordinator - Arizona State University
- Sam Nandakumar - Process Engineer - FlipChip International
- Sean Tropsa - CVD process Engineer - IM Flash
- Ibrahim Halloum - R&D Engineer - ZymoChem
- Tyson Bry - Construction Engineer and Project Manager -Department of Environmental Conservation, State of Vermont

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-

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 lead 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 LEADERSHP

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

Appendix

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

Research activities and outputs

Funded research

Faculty in the Swette Center have achieved success in leveraging the Swette Strategic Investment to obtain new research projects, including a number of large awards. The table below lists major new projects.

Sponsor	Principal Investigator	Title and Award Amount
City of Mesa (10/1/18-9/30/19)	PI Bruce Rittmann	*Food Waste Digestion for Mesa, Arizona*, **$113,775**
Electric Power Research Institute 7/1/18-6/30/19	PI Bruce Rittmann	*Mathematical and Process Model for Biological Transformation of Selenium Oxyanions,* **$138,033**
FXI, Inc. 2/15/18-11/30/18	PI Bruce Rittmann	*Testing of Polyurethane Foam,* **$43,545**
ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CBBG) Consortium (9/1/18-8/31/19)	PI Anca Delgado	*Passive Remediation of Acid Rock Drainage via Coupled Treatment Approach using an Organic Waste Stream and Basic Oxygen Furnace Slag*, **$82,787**
National Science Foundation (12/1/18-11/30/23)	PI Hinsby Cadillo-Quiroz	*CAREER: Geochemical and functional controls of methane-mediating microbes in Amazon peatlands, **$650,013***
Colorado School of Mines (9/6/18-9/5/21)	PI Treavor Boyer	*Regenerable resin sorbent technologies with regenerant solution recycling for sustainable treatment of per-and polyfluoroalkyl substances (PFASs), **$317,848***
ASU-Foundation (7/1/18-6/30/19)	PI Treavor Boyer	*Phoenix/Scottsdale Groundwater Contamination Endowment for Research on the Risks and Mitigation of Chemical Releases to the Environment, **$10,000***
ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CBBG) Consortium (8/18/17-7/31/2020)	PI Treavor Boyer	*Development of a Reactive Geocomposite Mat (RGM) Containing Steel Slag Fines and Organic Media to Remove Nitrogen and Phosphorus from…, **$146,189***
Matrix New World Eng (4/2/18-3/29/19)	PI Rosa Krajmalnik-Brown	*Matrix New World Associated Project; PGAN Column Studies,* **$33,965**
Aquarius Technologies, LLC (7/15/18-1/14/19)	PI Bruce Rittmann and Joshua Boltz	*A model of selected microfauna and meiofauna predation in a biofilm reactor,* **$20,002**
Finch Therapeutics/Crestovo (3/1/18-9/30/18)	PI Krajmalnik-Brown	*Microbiome analyses for successful FMT trials for individuals with ASD,* **$90,013**
ASU: Center for Bio-Mediated and Bio-Inspired Geotechnics (CBBG) Consortium (8/18/17-7/31/2020)	PI Cesar Torres	*Electrokinetics-Facilitated MICP-EICP (EK-MICP/EICP) in Fine-Grained Soils, **$157,445***
DOD-ARMY-USAMRAA W81XWH-16-1-0492 (9/1/16-8/31/20)	PI Adams co-PI Krajmalnik-Brown	*Treating gastrointestinal and autism symptoms in adults with autism using Microbiota Transfer Therapy (MTT),* **$ 1,293,794**
ASU Foundation, 30007312	PI Adams, co-PI Krajmalnik-Brown	*Long-term Follow-up on Beneficial Bacteria Treatment Study,* **$28,008**

NSF-ENG-CBET, CAREER 1713704 (7/15/2016 - 12/31/2018)	PI Boyer	*Sustainable Urine Processes through integration of Education and Research,* **$156,627**
NASA-GODDARD SPACE FLIGHT CTR NNX15AD53G (12/31/14-12/30/19)	co-PI Cadillo-Quiroz	*Exoplanetary Ecosystems: Exploring Life's Detectability on Chemically Diverse Exoplanets,* **$6,097,436**
NSF-GEO-OCE 1658527 (3/15/17-2/29/20)	co-PI Cadillo-Quiroz	*Aggregation of Marine Picoplankton,* **$687,521.00**
NSF-BIO-DEB 1355066 (5/1/14-4/30/19)	PI Cadillo-Quiroz	*Collaborative Research: Forest productivity and hydrological patterns regulate methane fluxes from peatlands in the Amazon basin,* **$626,999.00**
NSF-BIO-DEB 1637590 (12/1/16-11/30/18)	co-PI Cadillo-Quiroz	*LTER CAP IV: Design with Nature,* **$4,508,000**
National Science Foundation, NSF-ENG-EEC 1449501 (08/01/17–07/31/20)	PI Kavazanjian, Co-PIs Krajmalnik-Brown, Torres, Rittmann, Boyer, Cadillo-Quiroz	*Center for Bio-mediated and Bio-inspired Geotechnics***, $18-million**
National Institutes of Health, HHS-NIH 1R01DK105829-01A1 (9/1/16-6/30/21)	PI Krajmalnik-Brown, co-PIs Rittmann, Marcus	*Integrating Quantitative Energetics Determines the Microbiomes Contribution to Energy Balance*, **$3,936,800**
Mayo Clinic Arizona ARI-225822 (3/1/17-8/31/18)	co-PI Krajmalnik-Brown	*Obesity in Menopause: The role of estrogen therapy on the gut microbiome and host,* **$50,000**
Department of Energy, DOE DE-EE0007562 (10/1/16-9/30/18)	PI Lammers, co-PI Krajmalnik-Brown	*A novel platform for algal biomass production using cellulosic mixotrophy,* **$1,689,791**
Department of Energy, DOE-EERE DE-EE0007093 (10/1/15-9/30/18)	PI Rittmann,	*Atmospheric CO2 Capture and Membrane Delivery,* **$1 million**
National Science Foundation, NSF-ENG 1509933 (7/1/15-6/30/19)	PI Rittmann	*NO COST EXTENSION: Targeted saturated fatty acids synthesis by microbial biohydrogenation and its superior extraction from microalgae biomass through fermentation,* **$309,443**
National Science Foundation, NSF-ENG 1702445 (7/1/17-6/30/20)	PI Rittmann	*Enhancing Biodegradation of Quaternary Ammonium Compounds (QAC),* **$329,738**
Department of Defense, DOD-SERDP W912HQ-17-C-0013 (04/01/17-04/05/19)	PI Rittmann co-PI Krajmalnik-Brown	*Synergistic Reductive Dechlorination of 111-Trichloroethane and Trichloroethene,* **$200,000**
National Science Foundation, NSF-ENG 1603656 (7/1/16-6/30/19)	PI Rittmann, co-PI Torres	*SusChEM: Engineering the Hollow-Fiber Membrane Biofilm Reactor to Convert Syngas to Valuable Products,* **$209,022**
Department of Defense, DOD-NAVY-ONR N00014-15-1-2702 (9/1/15-10/31/18)	PI Torres co-PI Krajmalnik-Brown	*Combining Electrochemical -Omics and Microscopic Approaches to Characterize Transport Limitations in Anode-Respiring Bacteria Biofilms,* **$448,955**
Department of Defense, DOD-NAVY-ONR N00014-15-1-2571 (05/01/15-12/31/18)	PI Torres	*NO COST EXTENSION: Development of Substrate-loaded Microbial Fuel Cells for Powering Remote Sensors,* **$399,775**
NSF-BIO-DBI 1531991 (09/01/15-08/31/18)	PI Spence Co-PI Torres	*MRI: Acquisition of Cryo-EM for Southwest Regional Center,* **$2,825,509**

Patents issued, licensed, or applications pending
(Current Swette Center members in boldface)

Rittmann, B., Klaus, L., Justin, F., **Megha, P.**, & Allen, W. (2018). Systems and methods of atmospheric carbon dioxide enrichment and delivery to photobioreactors via membrane carbonation. U.S. Patent No. 15/564,862. Washington, DC: U.S. Patent and Trademark Office (application pending).

Papers published or accepted in the second half of 2018
(Current Swette Center members and alumni in boldface)

1. **Alrashed W, Lee J, Park J, Rittmann BE, Tang, Y,** Neufeld JD, **Lee HS** (2018 Sep 15). Hypoxic methane oxidation coupled to denitrification in a membrane biofilm. *Chemical Engineering Journal*; Vol 348, 745-753. https://doi.org/10.1016/j.cej.2018.04.202.

2. **Boyer TH**, Hu Y (2018 Nov 1). Removal of multiple drinking water contaminants by combined ion exchange resin in a completely mixed flow reactor. *Journal of Water Supply: Research and Technology-Aqua*; Vol 6 (7): 659-672. https://doi.org/10.2166/aqua.2018.101.

3. Brown MT, **Boyer TH**, Sindelar RJ, Arden S, Persaud A, Brandt-Williams S (2018 Oct 1) A Floating Island Treatment System for the Removal of Phosphorus from Surface Waters. *Engineering*; Vol 4 (5), 597-609. https://doi.org/10.1016/j.eng.2018.08.002.

4. Cao L, Zhang C, Zou S, Zhu G, Li N, Zhang Y, **Rittmann BE** (2018 Nov 15)**.** Simultaneous anaerobic and aerobic transformations of nitrobenzene. *Journal of Environmental Management*; Vol 226, 264-269. https://doi.org/10.1016/j.jenvman.2018.08.007.

5. Cui, X.; Huo, M.; Chen, C.; Yu, Z.; **Zhou, C.;** Li, A.; Qiao, B.; Zhou, D.; **Crittenden, J.C.** 2018. Low concentrations of Al(III) accelerate the formation of biofilm: Multiple effects of hormesis and flocculation. Science of the Total Environment, 634: 516-524.

6. Deng Y, Liu NY, Tsow F, Xian X, **Krajmalnik-Brown R,** Tao N, Forzani E (2018 Aug 14). Tracking Personal Health-Environment Interaction with Novel Mobile Sensing Devices. *Sensors*; *18*, 2670.

7. **Jagtap N**, **Boyer TH** (2018 Aug 19). Integrated, multi-process approach to total and customizable nutrient recovery from hydrolyzed urine. *Abstracts of Papers of the American Chemical Society*; 256.

8. **Kalinowski T**, McClellan K, Bruton TA, **Krajmalnik-Brown R**, Driver EM, **Halden RU**. 2018 "Autonomous Screening of Groundwater Remediation Technologies in the Subsurface Using the In Situ Microcosm Array (ISMA). Hazardous Materials. In Press. https://doi.org/10.1016/j.jhazmat.2018.12.054

9. Lai CY, Dong QY, **Rittmann BE, Zhao HP** (2018 July 12). Bioreduction of Antimonate by Anaerobic Methane Oxidation in a Membrane Biofilm Batch Reactor. *Environmental Science and Technology*; Vol 52 (15), 8693-8700. **DOI:** 10.1021/acs.est.8b02035.

10. **Lai YJ**, **Zhou Y**, **Eustance E**, **Straka L**, Wang Z, **Rittmann BE (**2018 Sep 1). Cell disruption by cationic surfactants affects bioproduct recovery from *Synechocystis* sp. PCC 6803. *Algal Research*; Vol 34, 250-255. https://doi.org/10.1016/j.algal.2018.08.010.

11. **Lee H., Tang Y, Rittmann BE, Zhao HP** (2018 Nov 30). Anaerobic oxidation of methane coupled to denitrification: fundamentals, challenges, and potential. *Critical Reviews in Environmental Science and Technology*; 1-27. DOI: 10.1080/10643389.2018.1503927.

12. Li A, **Zhou C**, **Liu Z**, Xu X, **Zhou Y**, **Zhou D**, **Tang Y**, Ma F, **Rittmann BE** (2018 July). Cover Image, Volume 115, Number 7. *Biotechnology and Bioengineering*. https://doi.org/10.1002/bit.26421.

13. Li A, **Zhou C**, **Liu Z**, Xu X, **Zhou Y**, **Zhou D**, **Tang Y**, Ma F, **Rittmann BE** (2018 July). Direct solid-state evidence of H2-induced partial U(VI) reduction concomitant with adsorption by extracellular polymeric substances (EPS). *Biotechnology and Bioengineering*. https://doi.org/10.1002/bit.26592.

14. Li Q, Fu L, Wang Y, **Zhou D**, **Rittmann BE** (2018 Nov 11). Excessive phosphorus caused inhibition and cell damage during heterotrophic growth of Chlorella regularis. *Bioresource Technology*; Vol 268, 266-270. https://doi.org/10.1016/j.biortech.2018.07.148.

15. **Liu Z**, **Zhou C**, **Ontiveros-Valencia A**, **Luo Y**, **Long M**, **Xu H**, **Rittmann BE** (August 2018). Cover Image, Volume 115, Number 8. *Biotechnology and Bioengineering*. https://doi.org/10.1002/bit.26423.

16. **Liu Z**, **Zhou C, Luo YH, Ontiveros-Valencia A, Long M,** Ang L and **Rittmann BE** (2018 July 4). Accurate O2 delivery enabled aerobic benzene activations followed by denitrification-coupled degradation. *Biotechnol. Bioengr*; 115: 1988–1999.

17. **Liu Z**; **Zhou C**; **Ontiveros-Valencia A**; **Luo YH**; **Long M**; **Xu H**; Li A; **Rittmann BE**. Continuous Benzene Removal through Aerobic Benzene Activation Followed by Denitrification-Coupled Degradation in a O2-based Membrane Biofilm Reactor. *Biotechnology & Bioengineering*, 115(8): 1988-1999.

18. **Long M**, **Ilhan E**, Siqing X, **Zhou C**, **Rittmann BE** (2018 Nov 1). Complete dechlorination and mineralization of pentachlorophenol (PCP0 in a hydrogen-based membrane biofilm reactor (MBfR). *Water Research*; Vol 144, 134-144. https://doi.org/10.1016/j.watres.2018.06.071.

19. Macintosh KA, **Mayer BK**, McDowell RW, Powers SM, Baker LA, **Boyer TH**, and **Rittmann BE** (2018 Oct 8). Managing Diffuse Phosphorus at the Source versus at the Sink. *Environmental Science & Technology; 52* (21), 11995-12009. DOI: 10.1021/acs.est.8b01143.

20. **Nguyen B** and **Rittmann BE** (2018 Aug 9). Low-cost optical sensor to automatically monitor and control biomass concentration in microalgal cultivation; *Algal Research* 32: 101-106.

21. **Ontiveros-Valencia A**, **Zhou C**, **Zhao HP**, **Krajmalnik-Brown R**, **Tang Y**, **Rittmann BE** (2018 Nov 11). Managing microbial communities in membrane biofilm reactors. *Appl Microbiol Biotechnol*; 102: 9003. https://doi.org/10.1007/s00253-018-9293-x.

22. Pandorf M, Hochmuth G, **Boyer TH** (2018 Dec 4). Human Urine as a Fertilizer in the Cultivation of Snap Beans (Phaseolus vulgaris) and Turnips (Brassica rapa). *Journal of Agricultural and Food Chemistry*, DOI: 10.1021/acs.jafc.8b06011.

23. Pandorf M, Hochmuth G, **Boyer TH** (2018 Aug 19). Urine, a sustainable fertilizer for the future? *Abstracts of Papers of the American Chemical Society*; 256.

24. **Ray H**, **Boyer TH**, Perreault F (2018 Aug 19). Urea recovery from fresh urine by forward osmosis and membrane distillation. *Abstracts of Papers of the American Chemical Society*; 256.

25. **Rittmann BE**, **Boltz JP**, Brockmann D, Daigger GT, Morgenroth E, Sørensen KH, Takács I, van Loosdrecht M and Vanrolleghem PA (2018 July 31). A framework for good biofilm reactor modeling practice (GBRMP). *Water Sci. Technol*; 77: 1149-1164. (DOI: 10.2166/wst.2018.021)

26. **Saetta D**, Padda A, **Leyva C**, Boscovic D, **Boyer TH** (2018 Aug 19). "Smart" nonwater urinals for urea stabilization, phosphorus recovery, and water conservation. *Abstracts of Papers of the American Chemical Society*; 256.

27. **Solanki A, Boyer TH** (2018 Nov 27). Physical-chemical interactions between pharmaceuticals and biochar in synthetic and real urine. *Chemosphere*; 218:818-826. doi: 10.1016/j.chemosphere.2018.11.179.

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29. **Straka L**, **Cahill B**, **Maldonado J**, **Rittmann BE**, **Krajmalnik-Brown R**. 2019 "Effects of Light Intensity on Soluble Microbial Products Produced by Synechocystis sp. PCC 6803 and Associated Heterotrophic Communities" Algal Research. *In Press.*

30. Tang J, Wu Y, **Esquivel-Elizondo S**, Sørensen SJ, **Rittmann BE** (2018 July 17). How Microbial Aggregates Protect against Nanoparticle Toxicity. *Trends in Biotechnology*; https://doi.org/10.1016/j.tibtech.2018.06.009.

31. Wang S, Zhuang Q, **Lähteenoja O**, Draper FC, **Cadillo-Quiroz H** (2018 Dec 4). Potential shift from a carbon sink to a source in Amazonian peatlands under a changing climate. *Proceedings of the National Academy of Sciences*; Vol 115 (49), 12407-12412. https://doi.org/10.1073/pnas.1801317115.

32. Whisner CM, **Maldonado J,** Dente B, **Krajmalnik-Brown R,** Bruening M (2018 Dec 12). Diet, physical activity and screen time but not body mass index are associated with the gut microbiome of a diverse cohort of college students living in university housing: a cross-sectional study. *BMC Microbiology*; Vol 18 (1), 210. https://doi.org/10.1186/s12866-018-1362-x.

33. **Yu J.**, Deem L. M., Crow S. E., Deenik J. L., Penton C.R. (2018). Comparative Metagenomics Reveals Enhanced Nutrient Cycling Potential After Two Years of Biochar Amendment in a Tropical Oxisol. Appl and Environ Microbiol (Manuscript Submitted).

34. **Yu J.**, Deem L. M., Crow S. E., Deenik J. L., Penton, C. R. (2018). Biochar application influences microbial assemblage complexity and composition due to soil and bioenergy crop type interactions. *Soil Biology and Biochemistry*, *117*, 97-107. DOI: 10.1016/j.soilbio.2017.11.017

35. **Zhong N**, Chen M, **Luo Y**, **Wang Z**, Xin X and **Rittmann BE** (2018 Sep 1). A novel photocatalytic optical hollow-fiber with high photocatalytic activity for enhancement of 4-chlorophenol degradation. *Chem. Engr. J.*; 355: 731 – 739.

36. **Zhou Y**, **Lai YJ**, **Eustance E**, **Rittmann BE** (2018 Dec 18 web). 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.* DOI: 10.1021/acssuschemeng.8b04776.

37. **Zhou Y**, Eustance E, Straka L, Lai YJ, Xia S and Rittmann BE (2018 Oct 19). Quantification of heterotrophic bacteria during growth of Synechocystis sp. PCC 6803 using fluorescence activated cell sorting and microscopy. *Algal Research*; 30: 94 – 100.

38. **Zhou Y**, **Marcus AK**, **Straka L**, **Eustance E**, **Lai YS**, Xia S, **Rittmann BE** (2018 Nov 10) Uptake of phosphate by Synechocystis sp. PCC 6803 in dark conditions: Removal driving force and modeling. Chemosphere. 218:147-156. DOI: 10.1016/j.chemosphere.2018.11.056.

39. **Zhou C**; **Ontiveros-Valencia A**; Nerenberg R; **Tang Y**; Friese D; **Krajmalnik-Brown R**; **Rittmann BE** 2018. Hydrogenotrophic Microbial Reduction of Oxyanions with the Membrane Biofilm Reactor. Frontiers in Microbiology, (accepted)

40. Zou S, Zhang B, Zhang C, **Xu H**, Zhang Y, **Rittmann BE** (2018 July 2). Competition for molecular oxygen and electron donor between phenol and quinoline during their simultaneous biodegradation. *Proc. Biochem.*; DOI.org.10.1016/j.procbio.2018.04.015.

Proceedings and presentations

(Swette Center presenters in bold)

1. **Altizer M**, Martin K, Mahabad N, **Zermeno D**, Kavazanjian E, van Paasen L, **Krajmalnik-Brown R**, **Torres C**,. October 2018. "Electrokinetic Subsurface Transport for Soil Remediation and Mineral Precipitation." (Poster presentation) CBBG Annual Meeting, Tempe, AZ.

2. **Brown-Muñoz F**, **Ki D**, **Torres CI**. Gas Diffusion Layer Optimization for Substrate-Loaded Underwater Microbial Fuel Cells. Society of Hispanic Professional Engineers National Convention 2018. Cleveland, OH. November 9, 2018.

3. **Brown-Muñoz F**, **Ki D**, **Torres CI**. Gas Diffusion Layer Optimization for Substrate-Loaded Underwater Microbial Fuel Cells. School for Engineering of Matter, Transport, and Energy Symposium. Tempe, AZ. November 30, 2018.

4. **Davis T. and Marcus A.** Linking metabolizable energy and chemical oxygen demand. AICHE 2018 Fall Meeting, Pittsburgh, PA, October 2018.

5. **Delgado A.** Interference of natural organics with total petroleum hydrocarbons analyses. Invited speaker at Chevron Energy and Technology, San Ramon, CA, December 2018.

6. **Eustance E**, **Lai YJ**, **Shesh T**, **Rittmann BE**. Membrane Carbonation for Improved Carbon Capture Efficiency in Algal Cultivation. Algae Biomass Summit 2018, Woodlands, TX, October 16.

7. **Hall CA,** van Paassen LA, Kavazanjian E, and **B. Rittmann**. Multiphase Biogeochemical Model to Predict Microbially Induced Desaturation and Precipitation at Field-Scale. 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

8. **Hall CA**, Hernandez G, Darby K, van Paassen L, Kavazanjian E, DeJong J, Wilson D. Centrifuge Model Testing of Liquefaction Mitigation via Denitrification-Induced Desaturation2. Geotechnical Earthquake Engineering and Soil Dynamics V (GEESD V), Austin, TX, June, 2018.

9. **Hall CA**, van Paassen L, Kavazanjian E, and **Rittmann BE**. Microbially Induced Desaturation and Precipitation (MIDP) via Denitrification During Centrifugal Loading2.Interpore, New Orleans, LA. May, 2018

10. **Hall CA,** Khatami S, Illingworth S, Roop H, and van Emmerik T. Bridging Science and Policy for Change: Best Practices. 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

11. **Hall CA.** and Khatami S. Building Communities through Shared Experiences: Social Dimensions in AGU. 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

12. **Hall CA**, Beria H, Brown MRM, Cheng FY, Gootman KS, Hermes A, Khatami S, Preziosi-Ribero A, Sehgal V, Richardson M, and Yan Q. Beyond the Water Cooler: Networking Lessons Learned by the Hydrology Section Student Subcommittee (H3S) . 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

13. **Hall CA**, Smit Y, **Altizer M**. Journal for the Unpublishable: "Bad" Data and Non-Discovery. European Geoscience Union Assembly, Vienna, Austria. March, 2018.

14. **Hart S** and **Torres CI** "Measuring pH gradient dynamics inside anode respiring biofilms" at the North American meeting of the International Society for Microbial Electrochemistry and Technologies, October 2018.

15. **Howley E** and **Torres CI** RNAseq: Electron acceptor and physiology of G. sulfurreducens. North American International Society for Microbial Electrochemistry and Technology meeting, October 2018.

16. Khatami S, Beria H, Claes N, Dogulu N, **Hall CA**, Knoben W, Popp A, van Emmerik THM, Cox C. Young Hydrologic Society (YHS): vision, mission, and strategy[1]. 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

17. **Krajmalnik-Brown R**. Successful Biomediated Contaminant Removal: The Ground is a Great Source for Bioremediating Microbial Cultures. Plenary talk B2G Atlanta. September 2018.

18. **Lai YJ**, **Eustance E**, **Shesh T**, **Rittmann BE**, Enhanced CO2 delivery via membrane carbonation for sustained Scenedesmus cultivation with various CO2 concentrations. Algae Biomass Summit 2018, Woodlands, TX, October 16

19. **Liu Y**, **Lai YS**, **Barbosa T**, **Chandra R**, **Parameswaran P**, **Bruce E. Rittmann**. Electro-selective fermentation enhances lipid extraction and biohydrogenation of Scenedesmus acutus biomass. 8th International Conference on Algal Biomass, Biofuels and Bioproducts, Seattle, WA, June 11 - 13, 2018.

20. **Luo Y**, **Zhou C**, Wang B, **Krajmalnik-Brown R**, **Tang Y** and **Rittmann BE**. A Synergistic Platform for Pd-catalytic Reduction of 1,1,1-Trichloroethane and Trichloroethene Followed by Biological Co-metabolism of 1,4-Dioxane. SERDP & ESTCP Symposium, Washington D.C., November 2018.

21. **Mohana Rangan S**, **Ibrahim H**, **Delgado A**, **Krajmalnik-Brown R**. Poster. Enriching Anaerobic Micro-organims to Reduce Hexavalent Chromium. B2G Atlanta Symposium, Atlanta, GA, September 13, 2018.

22. **Peraza I**, **Marcus A**. Mathematical modeling of electroactive biofilms at the first meeting of CONACYT fellowships in United States in Washington DC from 15 to 17 of March.

23. **Peraza, I**. *My personal journey as a scientist*. Technological Institute of Merida, Yucatan, Mexico, May 2018.

24. **Rittmann BE.** With A Little Help from Our Friends and the Stockholm Water Prize. Swedish-American Chamber of Commerce: Scottsdale, AZ, November 5, 2018.

25. **Rittmann BE.** With A Little Help from Our Friends and the Stockholm Water Prize. Spirit of the Senses: Biodesign Institute, Tempe, AZ. December 9, 2018.

26. **Rittmann BE.** Enabling Biodegradation of Recalcitrant and Toxic Organic Contaminants. Brown University, Providence, RI. November 2, 2018.

27. **Rittmann BE.** Understanding and Managing Microbial Communities in Membrane Biofilm Reactors. Annual Conference of the Chinese Society for Microbial Ecology, Guangzhou, PRC. November 10, 2018.

28. **Rittmann BE.** Reducing Oxidized Contaminants Using the H_2-Based MBfR. Southern University of Science & Technology, Shenzhen, PRC. November 11, 2018.

29. **Robles A**, **Delgado AG** "Reductive Dechlorination of Trichloroethene Sustained by Microbial Metabolic Chain Elongation". ASU FURI Symposium. Tempe, AZ Nov. 2018 (Poster Presentation).

30. **Robles A**, **Yellowman TL** "Reductive Dechlorination of TCE Sustained by Microbial Metabolic Chain Elongation". CBBG's NSF Site Vist. Tempe, AZ. Nov. 2018 (Poster Presention).

31. **Sarno, A.**, Humphreys, E., Olefeldt, D., Heffernan, L., Kolka, R., Roman, T., Sebestyen, S., Yavitt, J., **Finn, D.**, **Cadillo-Quiroz, H.** Poster presentation, ISME 2018 meeting, Leipzig, Germany. Microbial communities and methane production From Northern Peatlands Across a Climate Gradient.

32. Sehgal V, Beria H, Brown MRM, Cheng FY, Gootman KS, **Hall CA**, Hermes A, Khatami S, Preziosi-Ribero A, Richardson M, and Yan Q. Outsmart Your Research with Contemporary Technology [3]. 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

33. **Severson C**, Heshmati N, Torres Hurtado S, Tunnell J, Betancourt T. Investigation of the Synergism of Anti-Cancer Treatment with ICG and DOX- loaded nanoparticles. STEM Undergraduate Research Symposium, Texas State University, San Marcos, Texas, August 2018 and Biomedical Engineering Society Annual Meeting, Atlanta, Georgia, October 2018.

34. **Torres CI**, **Ki D**, **Kupferer R**. 2018. Hydrogen peroxide production and primary sludge treatment in microbial fuel cells: a flux and rate analysis. North-America ISMET Meeting, University of Minnesota.

35. van Emmerik T, Illingworth S, Hut R, and **Hall CA**. Rhyme Your Research Workshop. 2018 American Geophysical Union Fall Meeting, Washington, DC, December 2018.

36. van Paassen LA, Hall CA. Field Trials on Bio-based Ground Improvement. 2019 Geo-Congress, Philadephia, PA. March, 2019.

37. van Paassen LA, **Hall CA**, Stallings E, Kim D, Wang L, Mahabadi N, Zapata C, and Kavazanjian E. A Multi-Scale Approach Towards Improved Design and Better Understanding of Bio-Based Ground Improvement Methods. 2018 World Congress on Advances in Civil, Enviornmental, and Materials Research (ACEM18). Incheon, Korea. August, 2018.

38. van Paassen L, Kim D, Mahabadi N, **Hall CA**, Borah D, Stallings E, Wang L, Zapata C, and Kavazanjian E. A multi-scale approach towards understanding the effects of biogenic gas formation on the mechanical behavior of granular soil. ISSMGE: Technical Committee 105 Symposium, Atlanta, GA. September, 2018.

39. **Young M**, **Ki DW**, **Rittmann BE**, **Torres CI**. "Mathematical modeling to predict microbial electrochemical cell (MxC) performance using primary sludge feedstock." The North America Meeting of the International Society of Microbial Electrochemistry and Technologies (ISMET). October 2018.

40. **Yu, J.**, Deem, L., Crow, S.E., Deenik, J., Penton, C.R. (2018) Microbiomes and Metagenomes of Biochar-Amended Agricultural soils. Science and Mathematics Colloquium Series. Arizona State University – Polytechnic Campus. Mesa, AZ

41. **Yu, J.**, Deem, L., Crow, S.E., Deenik, J., Penton, C.R. (2018) Soil Microbial Community Response to Two Years Biochar Amendment Revealed by Metagenomics. International Society of Microbial Ecology (ISME). Leipzig, Germany

42. **Zhou C**; **Rittmann BE**. H2-utilizing Biofilm Embedded with Palladium Nanoparticles (PdNP-Biofilm): Assembly, Characterization, and Application in Enhancing Denitrification. Oral presentation at the 256th American Chemistry Society (ACS) National Meeting, Boston, Massachusetts, August 19-23, 2018.

Mentoring activities

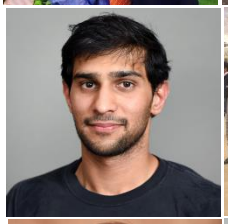
Degrees conferred

Ph.D.

Michelle Young. Dissertation Title: Understanding the Mechanisms and Potential of Microbial Peroxide-Producing Cells (MPPCs). Ph.D. in Environmental Engineering. Bruce Rittmann and Cesar Torres advisors.

Masters

Vineet Aswathi M.S. in Civil, Environmental and Sustainable Engineering. Bruce Rittmann advisor, Diana Calvo Martinez mentor.



Rebecca Dietz. Applied project: *Evolution of Water Quality in a New Green Building*. M.S. Chemical Engineering. Treavor Boyer advisor.

Francisco Brown-Munoz. Applied project title: *Gas Diffusion Layer Optimization for Substrate-Loaded Underwater Microbial Fuel Cells (SLUMFCs)*. M.S. Chemical Engineering, Ira A. Fulton Schools of Engineering, School for Engineering of Matter, Transport, and Energy. César Torres advisor, Dongwon Ki mentor.

Ethan Howley. M.S. Eng in Environmental Engineering; will continue to Ph.D. César Torres advisor.

Yihao Luo. Thesis Title: *Synergistic Reductive Dechlorination of 1,1,1-Trichloroethane and Trichloroethene and Aerobic Degradation of 1,4-Dioxane*. M.S. in Environmental Engineering; will continue to Ph.D. Bruce Rittmann advisor, Chen Zhou mentor.

Tarun Shesh. Thesis title: *Carbon dioxide transfer characteristics of hollow-fiber, composite membranes.* M.S. in Chemical Engineering; will continue to Ph.D. Bruce Rittmann advisor, Sean Lai and Everett Eustance mentors.

Thiago Stangherlin Barbosa. M.S. in Civil, Environmental and Sustainable Engineering, Masters in Passing. August 9, 2018.

Undergraduate

Theodora Yellowman, B.S. in Biochemistry

Mentoring relationships (mentors in parentheses)

Ph.D.

Megan Altizer (Krajmalnik-Brown, Torres)
Steffen Buessecker (Cadillo Quiroz)
Diana Calvo Martinez (Rittmann)
Lerys del Moral (Boyer)
Neng Iong Chan (Rittmann)
Tengfei Chen (Rittmann)
Taylor Davis (Rittmann)
Blake Dirks (Krajmalnik-Brown)
Michael Edgar (Boyer)
Caitlyn Hall (Rittmann)
Steven Hart (Torres)
Ethan Howley (Krajmalnik-Brown, Torres)
Neha Jagtap (Boyer)
Christine Lewis (Torres/Rittmann, Eustance)
Yuanzhe Liu (Rittmann, Lai)
Yihao Luo (Rittmann)
Evelyn Miranda (Delgado, Lai)
Srivatsan Mohana Rangan (Delgado, Krajmalnik-Brown)
Gandhar Pandit (Cadillo-Quiroz)
Isaias Peraza (Rittmann)
Hannah Ray (Boyer)
Mark Reynolds (Cadillo-Quiroz, Krajmalnik-Brown)
Rain Richard (Boyer)
Daniella Saetta (Boyer)
Analissa Sarno (Cadillo Quiroz)
Thiago Stangherlin Barbosa (Rittmann, Eustance, Lai)
Burcu Yavuz (Rittmann)
Michelle Young (Rittmann)
Julian Yu (Cadillo Quiroz)
Chenwei Zheng (Rittmann, Lai, Zhou)

Masters

Vineet Awasthi (Calvo Martinez)
Francisco Brown-Munoz (Torres)
Gururaj Daptardar (Rittmann, Eustance, Lai)
Rebecca Dietz (Boyer, Saetta)
Rick Kupferer (Rittmann, Young)
Yihao Luo (Rittmann, Zhou)
Zeni Ramirez (Cadillo Quiroz)
Shefali Rao (Delgado and Krajmalnik-Brown)
Urusha Regmi (Boyer)
Aide Robles (Delgado)
Tarun Shesh (Rittmann, Lai, Eustance)

Post-Doctoral Researchers

Everett Eustance (Rittmann)
Dongwon Ki (Torres)
Outi Lähteenoja (Cadillo Quiroz)
Chao Zeng (Krajmalnik-Brown)

Research Scientists

Daewook Kang (Krajmalnik-Brown)
Yen-Jung Lai (Rittmann)
Chen Zhou (Rittmann)

Undergraduates

Veronica Ayala Bojorquez (Rittmann, Kupferer, Young)
Randy Bravo (Krajmalnik-Brown, Dirks)
Jordan Canning (Cadillo Quiroz)
Debbie Chang (Krajmalnik-Brown, Dirks)
Andrew Chavez (Cadillo-Quiroz, Sarno)
Sheridan Davis (Boyer, Solanki, Saetta)
Alex Drew (Cadillo-Quiroz)
Angela Egan (Boyer, Ray, Saetta)
Fred Elick (Cadillo-Quiroz)
Sam Greenberg (Boyer, Ray)
Ibrahim Ibrahim (Delgado, Mohana Rangan)
Brielle Januszewski (Rittmann, Chen), FURI
Evan Jones (Rittmann, Lai)
Jade Martinez (Boyer, Ray)
Lincoln Mtemeri (Torres, Ki)

Steven Nguyen (Rittmann, Liu)
Jigar Patel (Krajmalnik-Brown, Kang)
Michael Pavia (Cadillo-Quiroz)
Neil Rastogi (Rittmann, Liu)
Elias Rodriguez (Cadillo-Quiroz, Sarno)
Andrea Russell (Torres, Brown-Munoz)
Carli Severson (Delgado, Miranda)
Megan Sharifi (Rittmann, Kupferer, Young)
Riley Tesman (Rittmann, Kupferer, Young)
Theodora Yellowman (Delgado)
Morgan Yorkell (Cadillo-Quiroz, Sarno)
Diana Zermeno (Torres)

High School Students
Samihan Dani (Rittmann, Eustance, Lai), Hamilton High School
Josh Phillips (Rittmann, Lai, Zheng), Mountain View High School

Teachers
Allison McCaw, Mtn View HS (Rittmann, Lai)

Volunteers
Brad Lusk (Rittmann, Zhou)

Staff
Sarah Arrowsmith (Krajmalnik-Brown)
Carole Flores (Rittmann)
Carlos Leyva (Boyer)
Jigar Patel (Krajmalnik-Brown)
Matt Scholz PhD (Rittmann)
Rob Stirling (Rittmann)

Visiting scholars

(Mentors in parentheses)

1. Renata de Bello Solcia Guerrero PhD, Universidad de Sao Paulo, Brazil (Rittmann, Zhou)
   I joined to the Bruce's Team in September to develop the project entitled "Recovery of rare-earth elements and elemental sulfur from acid mine drainage (AMD)". The main goal of this project is to study the treatment of AMD using sulfate-reducing bacteria associated to the challenge of recover REE by precipitation with sulfide. It is also desirable to recover the residual sulfide as elemental sulfur by favoring the partial oxidation of sulfide under oxygen-limitation conditions.

2. Zifang Chi PhD, Key Laboratory of Groundwater Resources and Environment, Jilin University (Rittmann, Zhou)
   As a member of Dr. Rittmann's Team, I study and develop anaerobic methane oxidation (AMO)-based membrane biofilm reactors (MBfRs) with multi-electron acceptors, and also explore its potential application: (1) dechlorination of chlorinated solvents; (2) recovery of rare-earth elements under acid mine drainage.

3. Gamze Dogdu, Dept. of Environmental Engineering, Abant Izzet Baysal University, Turkey

4. Melanie Hekeu, PhD student from Marche Polytechnic University, Italy (Rittmann, Yavuz)

5. Liang Guo, College of Environmental Science & Engineering, Ocean University of China (Rittmann, Lai)

6. Huai Li, Key Laboratory of Wetland Ecology and Environment, Chinese Academy of Science (Rittmann, Zhou)
   I develop a new ethane (C_2H_6)-based membrane biofilm reactor under Bruce's Team, and have two goals: 1) to explore nitrate bioreduction using C_2H_6 and simulated natural gas (CH_4+ C_2H_6) as electron donors; 2) to dechlorinate chlorinated solvents using $C_2H_6$6 as the sole electron donor.

7. Min Long, PhD student from the College of Environmental Science and Engineering, Tongji University (Rittmann, Zhou)

8. Muriel Mercier-Bonin PhD, Research Scientist from the French National Institute for Agricultural Research in Toulouse, France exchanged ideas on microbial-nanoparticle interactions affecting human health and to explore collaborations with Drs. Marcus, Krajmalnik-Brown, and Rittmann.

9. JunDi Wang, School of Human Settlements and Civil Engineering, Jiaotong University (Delgado)

10. Kun Zhang PhD, College of Power and Energy Engineering, Harbin Engineering University (Rittmann, Lai)

11. Xiong Zheng PhD, College of Environmental Science and Engineering, Tongji University (Rittmann, Zhou)

12. Nianbing Zhong PhD, College of Optical and Electronic Technology, Chongqing University of Technology (Rittmann, Zhou)

13. Dandan Zhou, School of Environment, Northeast Normal University (Rittmann, Zhou)

Special activities

Sarah Arrowsmith MS, Research Laboratory Coordinator

Served Environmental Health and Safety as a Compliance Officer
Joined the American Chemical Society
Organized group trainings for CPR/AED/Fire Extinguisher Use with the Fire Marshal's Office
Served as a Center Ambassador for Valley of the Sun United Way
Organized All Center Yearly Team Building Event and BBQ

Participating in Biodesign's safety goggle campaign and United Way donations campaign on Halloween.

Francisco Brown-Muñoz

Member of the Society of Hispanic Professional Engineers, Tau Beta Pi, and the Society of Water and Environmental Leaders.
Teaching Assistant for FSE-194: Engineering Futures course, designed for high-achieving first-year scholars.
July 18, 2018: conducted tour for the Chief Science Officers of Arizona and their teachers.
Mentor for the Society of Hispanic Professional Engineers chapter at ASU
Panelist for the Noche de Ciencias (Science Night) at Gilliland Middle School. Tempe, AZ.

Neng Iong Chan, PhD Student, Environmental Life Sciences, Rittmann and Elser Labs

From May 7th to Nov 6th, 2019, I worked for the Soil and Water Management & Crop Nutrition Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, in Vienna, Austria. I developed a new methodology of soil phosphate oxygen isotope extraction and purification for the agency. I was also invited by the ETH Zürich as a visiting scholar to learn some phosphate oxygen isotope purification techniques in August.

Taylor Davis, PhD Student in Chemical Engineering, Rittmann and Krajmalnik-Brown Labs

Member of Society of Women Engineers, American Institute of Chemical Engineers, and the ASU Graduate and Professional Student Association (GPSA)
Volunteered at the Biodesign "Stranger Science" Homecoming tent on November 2, 2018
Gave a tour to 25 high school counselors on November 9, 2018
Volunteered as a grant reviewer for the ASU GPSA

Anca Delgado PhD, Assistant Professor, School of Sustainable Engineering and the Built Environment

May-July 2018 CBBG Research for Undergraduates (REU) Program. Student Raja Mabry from Phoenix College did research on microbial chain elongation under my guidance and with Aide Robles as lab mentor.

Rebecca Dietz, MS Student in Chemical Engineering, School of Engineering of Matter and Transport and Energy, Boyer Lab

July 2018, participated in the drilling of a water well and medical mission with Living Word Chapel (Oracle, AZ) and Global CHE Enterprises.
October 2018, mission to build housing in Mexico with Living Word Chapel

Blake Dirks, PhD Student in Microbiology, School of Life Sciences, Krajmalnik-Brown Lab

Member of Microbiology Graduate Student Association
Member of Arizona Science Policy Network
Practices Krav Maga

Everett Eustance PhD, Postdoctoral Research Scientist, Rittmann Lab

Served Environmental Health and Safety as a Compliance Officer
Track Chair Algae Biomass Summit 2018, Woodlands, TX, October 14-17, 2018

Carole Flores MS, Business Operations Manager

Served on the *Stranger Science* Biodesign Homecoming Committee, Aug-Nov 2018

Participated in Legislative District 18 Democrats activities as a Precinct Committeeperson (2017-2018)

Steven Hart, PhD Student in Civil, Environmental and Sustainable Engineering, Torres Lab

I coordinated the Prison Biology Education Program for its fifth year, leading a group of graduate and undergraduate students to teach an introductory biology course in a medium security Arizona prison.

I, along with Ethan Howley, led a teaching workshop for staff teachers in Perryville Women's Prison.

Anna Guerrero, PhD Student, Biology and Society, Torres Lab

I am a second year PhD student and my main appointment is with the Center for Biology and Society at ASU. My undergraduate degree is in microbiology and I am a professional scientific illustrator (I instruct a scientific illustration course in the School of Life Sciences). For my graduate degree, I am studying the history of biofilm science through images, from conceptual diagrams to scanning electron micrographs. This Fall, Steven (from the Torres Lab) mentored me in my bioimaging lab course (BIO 504). Steven and I spent the semester trying to find more optimal ways to image *Geobacter* biofilms with confocal microscopy. Steven introduced me to the world of environmental biotech and pretty much taught me everything about the practicalities and complications of imaging biofilms in flow cells. I will continue working with the Torres lab on other projects and with more powerful microscopy techniques in order to better understand how scientists and engineers make and use images of biofilms to change and advance the field.

Caitlyn Hall, PhD Student in Civil, Environmental and Sustainable Engineering, Rittmann Lab

2018 – Present	American Geophysical Union	*Convener*
2018 – Present	ASM Microbe Conference	*Reviewer*
2018 – Present	ASCE Geo-Congress Conference	*Reviewer*
2018 – Present	Arizona Science Policy Network	*Founder*
2018 – Present	Young Hydrologic Society Collection on Unexpected Results in Hydrology	*Chief-Executive Editor*
2018 – 2019	American Geophysical Union Student and Early Career Scientist Conference	*Chair, Convener*
2018 – Present	European Geosciences Union Young Hydrologic Society	*Board Member*
2018 – Present	American Geophysical Union Hydrology Section Student Subcommittee	*Chair*

Ethan Howley and I founded, developed and instructed *Science Policy for Scientists and Engineers*, a 2-semester course.

Course Description

This unique course proposes to address this new anxiety to act by directly engaging early career scientists in science policy. We will meet weekly to better understand the culture of science policy, such that early career scientists are better equipped to communicate with policy-makers and non-technical professionals. The students will take concepts learned in class and apply them in real situations, including attending and speaking at town halls and at public hearings. Guest lecturers will

share their experiences and give perspective on related topics. Finally, this course will culminate in several tangible outputs, including opinion editorials, refined elevator speeches, and a peer-reviewed journal article, to enrich the growing community of grassroots science policy advocacy by providing resources for others beyond the reach of this course.

Course Objective

At the conclusion of this course, students should be able effectively communicate the impact of their research to non-technical science policy professionals. Students will gain the confidence to interact with policy makers and the science policy community through practiced engagement with these communities. Further, they will be able to contextualize their research field within the broader science policy sphere and communicate this with other scientists.

Ethan Howley, PhD Student in Civil, Environmental and Sustainable Engineering, Torres and Krajmalnik-Brown Labs

Earned a M.S. Eng in Environmental Engineering from ASU in December
Active as a founding member of the Arizona Science Policy Network
Continued to co-teach a biology class in an Arizona state prison
Served on the ASU Biosciences Core Governance Board
Co-organized a science policy for scientists event on the ASU campus

Yen-Jung (Sean) Lai PhD, Associate Research Scientist, Rittmann Lab

Poster Review Committee, Algae Biomass Summit 2018, Woodlands, TX, October 14-17, 2018. (Sean)

Rosa Krajmalnik-Brown PhD, Associate Professor, School of Sustainable Engineering and the Built Environment

CBBG Environmental Protection and restoration Thrust leader
Tenure and promotion committee
Engineering Dean's Execute committee
Biosciences Managers and Governance Board Members

Yuanzhe Liu, PhD Student in Civil, Environmental and Sustainable Engineering, Rittmann Lab

Organizing committee of the Los Angeles Environmental Forum with Southern California Chinese-American Environmental Protection (SCCAEPA), August 2018, San Gabriel, CA.

Xiangxing Long, PhD Student in Civil, Environmental and Sustainable Engineering, Rittmann and Westerhoff Labs

NEWT Outreach Activity, teaching the middle school students by showing them how urban wastewater is treated and reused, October 2, 2018.

Yihao Luo, PhD Student in Environmental Engineering, Rittmann Lab

Yihao completed a Master's degree and will now pursue a PhD in the Rittmann Lab.

Evelyn Miranda, PhD Student in Biological Design, Delgado Lab

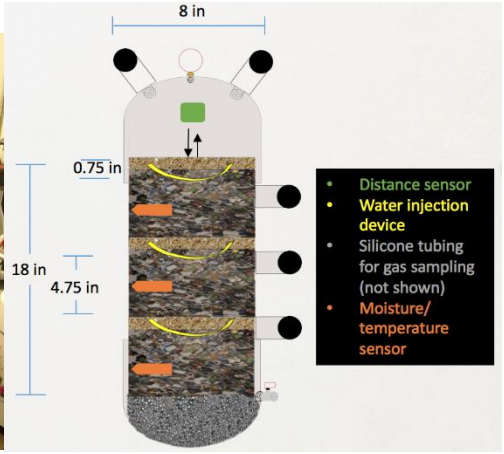
I have begun my official research! These are sulfate-reducing bioreactors for acid rock drainage remediation. From the four reactors, the two on the left are packed with bagasse and limestone the two on the right contain sugar beet pulp and limestone. We are hoping to see a reduction in sulfate concentration and an increase in pH from 2.5 to nearly neutral.

Isaias Peraza, PhD Student in Civil, Environmental and Sustainable Engineering, Marcus Lab

I finished my coursework in the PhD program with the class: Climate Change. As part of the course, I wrote a research paper title: The different theories to explain the great Maya collapse influenced by climatic events. I taught the workshop*: Mathematical Modeling in Environmental Engineering with MATLAB to Environmental Engineering Graduate Students* at the Engineering department at the Yucatan State University in May of 2018.

Mark Reynolds, PhD Student in Microbiology, Cadillo-Quiroz Lab

I passed the first part of the Microbiology Ph.D. comprehensive/qualifying exams. This required to pitch a research proposal outside of my primary research interests/dissertation project. Upon successful completion of my prospectus for my dissertation research, I will be promoted to Ph.D. candidate.



I was a Teaching assistant for BIO-282 lab (Conceptual approaches to Biology for Majors II).

I conducted lab tours with approx. (60) students who are participating in the "Chief Science Officer" program within their grade at school (http://chiefscienceofficers.org/). Students were selected for the lab tour field trip for being top-performing STEM students in partnering schools from Arizona, Mexico, and even as distant as Kuwait.

Caption: (left) 16L experimental bioreactor municipal solid waste landfill analogues in operation comparing biomethanation stimulants to a water-only control for its potential to upgrade landfill gas *in-situ*; (right) 16L experimental bioreactor schematic with specifications and included tubing/electronic/fabricated components.

Rain Richard, PhD Student, Civil, Environmental and Sustainable Engineering, Boyer Lab

Every year Sequoya Elementary School in Scottsdale hosts Art Masterpiece. This is an art walk family and friends participate in to view the wonderful art work displayed by the students of the school. The art pieces are created by the students as they mimic the artists they learn about throughout the year. This is an educational outreach program that is only possible by volunteer efforts. This year, in December a few of us from Swette who are also a part of Graduate Students for the Environment chose the topic "Sketch as Art" and spoke to 2nd graders about how sketching is actually a form of art. We discussed that before the time of the selfie and cameras the eyes were the most powerful tool for visualizing an event. We taught them that sketches were quick pieces of work intended to capture the moment and that scientists used sketches to capture their scientific discovery or observation. After our presentation, we put out magnifying glasses, beakers with colored water, test tubes with colored water, small cars, fake plants, pretty containers and a cute toy crab for the students to observe and sketch. As reported by the teacher (and my son), this was a very successful Art Masterpiece. The children realized the sketching was soothing, fun and had a very exploratory feel to it that came naturally. The kids will present their work in April during Sequoya's Art Walk.

Bruce Rittmann PhD, Director and Regents Professor

Organizing the Modeling Workshop in May or 2019
Machine Learning Workshop with Jackie MacDonald-Gibson on December 10.
Fiber Optics Workshop with Mathias Kolle (of MIT) on December 19 and 20.

Aide Robles, MS Student in Civil Environmental and Sustainable Engineering, Delgado Lab

Toured CBBG REU's participants through BSCEB. Toured local high school students through BSCEB.

Andrew Russel, BSE Environmental Engineering 2021, Torres Lab

Fulton Ambassador: Leads informational tours on campus and represents the Ira A. Fulton Schools of Engineering at special events oriented towards prospective students.

Analissa Sarno, PhD Student, Cadillo-Quiroz Lab

Presented MENTOR project and research goals to high students. Discuss and engage students in research discussion and undergraduate research options. Dec 4, 2018

Matt Scholz PhD, Program Manager of Sustainable Phosphorus Alliance

Matt Scholz, a program manager in the Center, has served on the Water Research Foundation's PAC group for developing requests for research proposals and on the ABBA committee of the biosolids industry, which brings together regional biosolids coordinators from across the country to share news of emerging issues relevant to the industry.

The Sustainable Phosphorus Alliance hosted the Phosphorus Field-to-Watershed Modeling Workshop, which brought 16 researchers and policy experts to Columbus, Ohio, on August 23rd and 24th. The group discussed soil test phosphorus measurements and their relationship to fertilizer application recommendations, status and trends of edge-of-field and in-stream water quality observations for the Maumee River basin (a tributary of Lake Erie), and existing models to simulate soil phosphorus and their application in the Maumee basin. More information here: https://phosphorusalliance.org/2018/08/28/831/

The Sustainable Phosphorus Alliance developed a two-volume, 370-page compendium of state regulations on the land application of biosolids and manure as an output of its Biosolids and Manure Task Force. The work, currently being reviewed by regulators from across the country, will provide a resource for the organic residuals industries to identify market challenges and opportunities and for policy makers and civil society to develop scenarios that yield more sustainable nutrient management practices.

The Sustainable Phosphorus Alliance received $50k in funding from the Moroccan phosphate mining company, The OCP Group, and $10k from its other members during this reporting period.

Carli Severson, Undergraduate, Biochemistry (Medicinal Chemistry), Delgado Lab

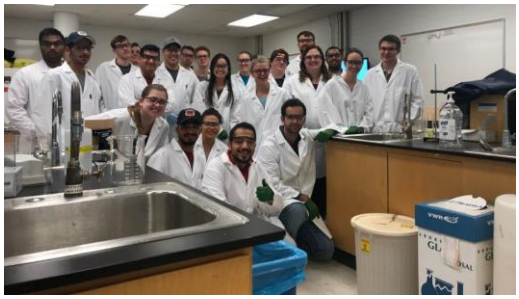
Wake Devils Member, ASU's competitive wake boarding team

Tarun Shesh, Masters Student, Chemical Engineering, Rittmann lab

Tau Beta Pi, Engineering Honor's Society, November 2018 (Tarun)

Thiago Stangherlin Barbosa, PhD Student, School of Sustainable Engineering and the Built Environment, Rittmann Lab

Thiago has taught 6 semesters the class CEE 361 – Introduction to Environmental Engineering as Teaching Assistant.



Thiago (front right) and his CEE361 class in Spring 2018.

Robert Stirling, Techno Economist, School of Sustainable Engineering and the Built Environment

I study Techno-Economics which examines the relationships between production cost modeling and engineering design choices. My end goal is to help researchers in the Swette Center make research and design choices which will ultimately result in commercializable products and services. I provide insights which support the research process. Fortunately, the Swette Center leadership is forward-looking in including Techno-Economics at all stages of the innovation and research processes.

In Spring of 2018, I completed the DOE Techno-Economic Analysis of Atmospheric CO2 Capture & Delivery to Algae via Membrane Carbonation, Final Report and the Techno-Economic Analysis of Carbon Valorization via plankton cultivation.

César Torres, Associate Professor, Chemical Engineering

International Society for Microbial Electrochemistry and Technology (ISMET) News Editor
ISMET Board Member
Environmental Microbiology Editorial Board Member
Tour for High school students interested in SEMTE, performed electronically (~100 students)
Graduate Committee for Chemical Engineering
ChE faculty advisor for the Grand Challenges Scholar Program

Lance Villarreal, Undergraduate, Biomedical Sciences BS, Biological Sciences MS, Rittmann Lab

I contributed to bioimaging and geo-imaging literature having used an SNE-4500M Plus to microscopically image soil from Toronto, Canada; aided in hydrochloric acid treatment and pH & calcium analysis of the soil as a member of the CBBG consortium.

I am president of the Tango Club at Arizona State University and Sun Devil Support Network (SDSN) advisor. I also participate in Rainbow Coalition, Barrett LGBT Club (BLC), Barrett Indigenous Culture Association (BICA), and the Barrett Care Squad.

I volunteer at the Tempe St. Luke's Hospital as a front desk assistant and Emergency Room (ER) assistant. I also volunteer as a recreational therapy assistant at the St. Luke's Medical Center Behavioral Health Center.

In October, I helped to organize a social event called "BSCEB Fishing and Fun" which included a baby shower for three employees.

Michelle Young, PhD Student, Environmental Engineering, Rittmann Lab

Volunteer at 2018 WEF Residuals and Biosolids conference in Phoenix, AZ
Member for AZ Water Association, AWWA, WEF, IWA, ISMET
November 2018: Led tour of BSCEB with City of Mesa, City of Tempe, and ARCADIS as part of the Cities of Mesa/Tempe Food Waste/Fats-Oils-Grease project

Julian Yu, PhD Student, Microbiology, Cadillo-Quiroz Lab

Fundraiser Coordinator: Succulent fundraiser for the Microbiology Graduate Student Association. Organize materials and coordinate the succulent fundraiser for MGSA.
Presentation at a community skill share: Microbiomes and Metagenomes of Biochar-Amended Agricultural soils.

Awards and accolades

(alphabetical by person after Fulton Schools of Engineering Dean's Fellows)

- Fulton Schools of Engineering Dean's Fellows:
  - Megan Altizer (SSEBE)
  - Taylor Davis (SEMTE)
  - Caitlyn Hall (SSEBE)
  - Ethan Howley (SSEBE)
  - Burcu Yavuz (SSEBE)

- Francisco Brown-Muñoz
  IMPACT Award: designed to promote, recognize and reward excellence in contributions made to the Fulton Schools of Engineering and the University, through innovative projects, mentoring, accomplishments in performance, personal achievements, advances in customer service, teamwork and exemplary leadership. See https://fullcircle.asu.edu/graduate/francisco-brown-munoz/ and https://intheloop.engineering.asu.edu/awards/.
  Ed Pastor Outstanding Graduate Award: awarded to an exemplary model of leadership through their academic accomplishments, community relationships, and the fostering of care and concern for their fellow students and community members. Awarded at the ASU Hispanic. See https://hispanicconvocation.asu.edu/forms/outstanding-student-award-nomination.

- Taylor Davis
  GPSA travel grant to attend the AICHE conference in October of 2018

- Anca Delgado
  Finalist for Outstanding Faculty Mentor award 2018, School for Sustainable Engineering and the Built Environment (will find out in early 2019).

- Anna Guerrero
  Graduate College Fellowship from ASU

- Steven Hart
  Received the volunteer of the year award for the Eyman prison complex.

- Srivatsan Mohana Rangan
  Received a scholarship award ($1500) from American Public Works Association (APWA), Arizona chapter on 18th July 2018.

- Bruce Rittmann
  Received the Stockholm Water Prize on August 29, 2018 from the Crown Princess Victoria of Sweden at a ceremony in Stockholm City Hall during World Water Week.

- Aide Robles
  Phoenix/Scottsdale Groundwater Contamination Scholarship
  Master's Opportunity in Research Engineering (MORE) Award
  Graduate College Award

- Analissa Sarno
  Graduate College Special Tuition Fellowship (IMSD), Fall 2018, renewed for Spring 2019

- Chen Zhou
  2018 Best Presentation, Division of Environmental Chemistry, the 256th American Chemistry Society (ACS) National Meeting, Boston, Massachusetts, August 19-23, 2018.

Collaborations

Krajmalnik-Brown Lab

Translational Research Institute in Orlando, FL: a five-year program investigating the effects of diet on colon microbial energy extraction in humans.
Cal Tech: quantification of microbial fermentation products in people with autism.
Midwestern University: links between gut microbiome dysbiosis, cancer, and infection diseases
Phoenix Indian Medical Center, National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)

Delgado Lab

Anca Delgado received research money from Freeport-McMoRan through CBBG to remediate acid rock drainage using agricultural wastes such as bagasse and using slag, which is waste from the steel industries. Repurposing these wastes makes the project sustainable. This collaboration is the first time that Freeport-McMoRan has partnered with ASU on remediation.

New babies!

On Saturday, July 21st 2018 our own BSCEB Lab Coordinator, Sarah Arrowsmith, and her husband Mike welcomed son Greyson into their family! Baby Greyson joins 3-year-old big brother Ashton. Congratulations Arrowsmith Family!

Social Events

This semester, we celebrated cooler weather with our families on a day of BSCEB Fishing & Fun at Dobson Ranch Park. The celebration included a baby celebration for babies Ki, Eustance, and Arrowsmith. We also spent time together at an International Holiday Potluck and White Elephant Gift Exchange in December.

The Swette Center continues to celebrate its members by hosting a monthly social gathering during which we provide birthday cake and time to mingle. As mentioned in the previous update, we continue to make our social events zero-waste events and strive to decrease our carbon footprint by reflecting on best practices every time.