

# making an impact

## Semi-annual Impact Report

Swette Strategic  
Investment Fund  
July 2019 – December 2019

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Director and Regents' Professor*



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**Swette Center  
for Environmental  
Biotechnology**



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

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

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

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

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

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

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

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

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

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

## OUR MISSION

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

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

# **CENTER GOALS**

## **I. BE THE LEADING GLOBAL CENTER IN ENVIRONMENTAL BIOTECHNOLOGY**

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

## **II. PERFORM AND DISSEMINATE TRANSFORMATIVE SCIENCE AND TECHNOLOGY**

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

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

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

## MEASURES OF SUCCESS

Success can be measured in many ways:

- Aspirations
- Awards
- Career Progression
- Center Feedback
- Collaborations
- Commercialization
- Courses (Developed, Delivered)
- Funding
- Graduates
- Infrastructure Strength
- Job Placements
- Outreach
- Patents
- Presentations
- Press Coverage
- Publications
- Recruiting
- Safety
- Scholar Diversity
- Service
- Space Utilization
- Spin-Outs
- Celebrations with Workmates
- Costume Contests
- Decorating Cubicles/Benches
- Donation Drives
- Goofy Faces
- Participation
- Smiles
- Social Support
- Time Spent with Labmates
- Time Spent on Projects
- TShirt Contests



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

## HIGHLIGHTS

### Krajmalnik-Brown Lab Research Featured in Economist Radio Podcast

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

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



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

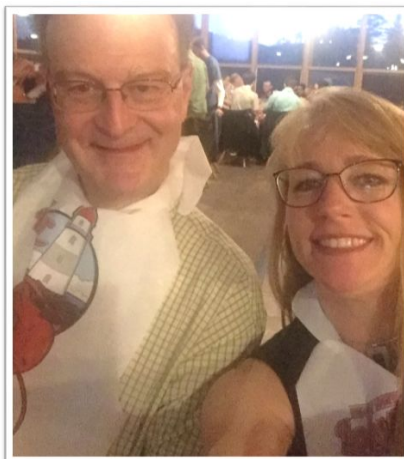
Dr. Treavor Boyer is the 2019 recipient of the Excellence in Service Award from the School of Sustainable Engineering and the Built Environment (SSEBE). Dr. Boyer was recognized for his outstanding leadership as the chairman of the committee that planned and carried out the 2019 Biennial Conference of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



### Rittmann and Lewis attend the Gordon Research Conference on Photosynthesis

Bruce Rittmann presented at the Gordon Research Conference on Photosynthesis: From the Biophysics of Natural and Artificial Photosynthesis to Bioenergy Conversion in Newry, Main in July 2019. His talk was titled *Realizing the Benefits of Delivering a Source of Concentrated CO<sub>2</sub>*.

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



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

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

### Dr. Rosy Presents Autism Webinar for Autism Research Institute

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

[HERE](#) is the link.



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

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

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





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

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

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

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



### **Needles and Sharps Training Program**

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



### **Our Solution:**

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

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

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

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



### **Delgado Lab Members Attend Phoenix College STEAM Day**

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



## Research Needed in Food Waste Co-digestion

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



<https://phosphorusalliance.org/>

## DOD SERDP and ESTCP Highlight Rittmann Lab Project

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

They also highlighted the project on their social media channels.

- [Twitter](#)
- [Facebook](#)
- [LinkedIn](#)



DoD's Environmental Research Programs

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

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

[MORE HERE](#)



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

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

*“The ability of people to define good work decays faster than their ability to execute it.”*

*“After a few cycles of small consistent victories, I was gaining momentum, like a snowball.”*

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



## Dr. Rosy Receives Outstanding Alumni Award from Universidad Autónoma Metropolitana

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



## Sudeep Popat receives \$750K NASA grant

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



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



Sarah Arrowsmith



Neng long Chan



Carole Flores



Khemlal Nirmalkar



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



**Celebrations**

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



## The Biodesign Institute is a place unlike any other.

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

### OUR APPROACH

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

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

### OUR INSPIRATION

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

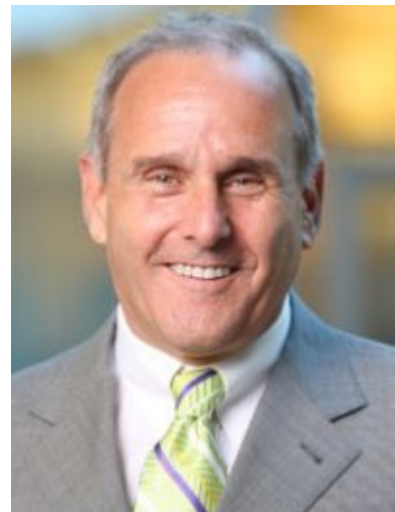
### THE BIODESIGN MODEL

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

### OUR LEADERSHIP

*Joshua LaBaer, MD, PhD*

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



# APPENDIX

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

## PUBLICATIONS

1. Adams JB, Vargason T, Kang DW, Krajmalnik-Brown R, and J Hahn (2019 Nov). Multivariate Analysis of Plasma Metabolites in Children with Autism Spectrum Disorder and Gastrointestinal Symptoms Before and After Microbiota Transfer Therapy. *Processes*, 7(11), 806. <https://doi.org/10.3390/pr7110806>
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12. Karadagli, F., A. K. Marcus, and B. E. Rittmann (2019). Role of hydrogen (H<sub>2</sub>) mass transfer in microbiological H<sub>2</sub>-threshold studies. *Biodegradation* 30: 113-125.
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36. Zheng X, Zhou C, Liu Z, Long M, Luo YH, Chen T, Ontiveros-Valencia A, and BE Rittmann (2019 Sep 01). Anaerobic biodegradation of catechol by sediment microorganisms: Interactive roles of N reduction and S cycling. *Journal of Cleaner Production.* 230, 80-89. <https://doi.org/10.1016/j.jclepro.2019.05.058>
  
37. Zhong, N., M. Chen, Y. Luo, and B. E. Rittmann (2019). A novel photocatalytic optical hollow fiber with high photocatalytic activity for enhancement of 4-chlorophenol degradation. *Chem. Engr. J.* 355: 731-739
  
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Membrane Biofilm Reactor. *Frontiers in Microbiology* 9: article 3268 (doi: 10.3389/fmicb.2018.03268).

39. Zhou, Y., A. Marcus, L. Straka, E. Eustance, Y.-J. Lai, S. Xia, and B. E. Rittmann (2019). Uptake of phosphorus by *Synechocystis* sp. PCC 6803 in dark conditions: removal driving force and modeling. *Chemosphere* 218: 147-156.
40. Zhou, Y., Y.-J. Lai, E. Eustance, and B. E. Rittmann (2019). Promoting *Synechocystis* sp PCC 6803 harvesting by cationic surfactants: alkyl-chain length and dose control the release of extracellular polymeric substances and biomass aggregation. *ACS Sustainable Chemistry & Engineering* 7: 2127-2133.
41. Zhou, Y., Y.-J. Lai, E. Eustance, S. Xia, and B. E. Rittmann (2019). Phosphate depletion affects lipids and heterotrophic bacteria accumulation in the batch growth of *Synechocystis* sp. PCC 6803. *Appl. Microb. Biotech.* 103: 5007-5014.
42. Zou, S., N. Yan, C. Zhang, Y. Zhou, X. Wu, J. Wang, Y. Liu; Y. Zhang, and B. E. Rittmann (2019). Acclimation of nitrifying biomass to phenol leads to persistent resistance to inhibition. *Sci. Total Environ.* 693: 133622 (doi.org/10.1016/j.scitotenv.2019.133622).

## POSTERS & PRESENTATIONS

1. Aerts J, Hut R, Drost N, van Werkhoven, van Haren R, Dzigan Y, Camphuijsen J, Alidoost F, Pelupessy I, Weel B, van den Oord G, Verhoeven S, Bouaziz L, van Verseveld W, Jagers B, Baart F, Sutanudjaja E, Hoch J, Melsen L, Bennett A, Arnal L, Fenicia F, Santos L, Gelati E, Molin M, Knobben W, Gharari S, Hall C, Hutton E, Van De Giesen N. (2019 December 13) ERA-Interim vs ERA-5 Hydrology Comparison. American Geophysical Union, San Francisco, CA.
2. Cadillo-Quiroz H and D Finn (2019 Dec 13). Primary Fermenter And Hydrogen-Consuming Microbial Keystone Taxa Are Associated With Carbon Use Efficiency In Tropical Peatlands Of Peruvian Amazonia. American Geophysical Union Fall Meeting, San Francisco, CA.
3. Davis T, Hall C, Rittmann B (2109 May 18). Modeling In-Situ Permeable Reactive Barriers (PRBs) for Subsurface Acid Mine Drainage (AMD) Remediation. AEESP, Tempe, AZ.
4. Drost N, Hut R, Van De Giesen N, van Werkhoven B, Aerts J, Pelupessy I, Weel B, Verhoeven S, van Haren R, Hutton E, van Meersbergen M, Alidoost F, van den Oord G, Dzigan Y, Camphuijsen J, Andela B, Hall C. The eWaterCycle platform for Open Science Hydrology. American Geophysical Union, San Francisco, CA.
5. Edgar M, and Treavor Boyer (2020 Jan 9). Biological Ion Exchange for the Removal of Natural organic Matter from Surface Waters. AZ Water, Phoenix AZ.

6. Glaser D, Finn D, Cadillo-Quiroz H, Perez-Montano S, Desch SJ, and HE Hartnett (2019 Dec 9). Microenvironments of Habitability in the Hyperarid Atacama Desert. American Geophysical Union Fall Meeting, San Francisco, CA.
7. Hall CA, Rittmann BE, Kavazanjian E, and LA van Paassen (2019 Dec 1). Multiphase Biogeochemical Model to Predict Microbially Induced Desaturation and Precipitation for Earthquake Hazard Mitigation. American Geophysical Union Fall Meeting, San Francisco, CA.
8. Hall C (2019 November 1). Communicating Science to Decision-makers Using Briefs and Opinion Editorials. Tampa, Florida.\*
9. Hall C (2019 December 2). Communicating Science to International Decision-makers Using Briefs and Opinion Editorials. Delft, Netherlands.\*
10. Hall C (2019 December 2). Early Career Scientists in Science Policy. Delft, Netherlands.\*
11. Hall C and van Emmerik T (2019 December 9). Rhyme Your Research: Science Through Poetry. American Geophysical Union, San Francisco, CA.\*
12. Hall C, Guimond J, van Emmerik T, and Illingworth S (2019 December 8). Building Momentum: Developing Sustainable Cross-Disciplinary Collaborations. American Geophysical Union, San Francisco, CA.
13. Hall C, Arveson S, Barickman M, Brugman K, Creasy N, Martin P, McIntosh Marcek H, Rao Y, Oakes R, and van Emmerik T. (2019 December 11). Early Career Scientist Forum. American Geophysical Union, San Francisco, CA.
14. Hall C, Drost N, Hut R, Van De Giesen N, van Werkhoven B, Aerts J, Pelupessy I, Weel B, Verhoeven S, van Haren R, Hutton E, van Meersbergen M, Alidoost F, van den Oord G, Dzigan Y, Camphuijsen J, Andela B. eWaterCycle: Putting the Public in Charge is Only FAIR. American Geophysical Union, San Francisco, CA.
15. Lewis, Christine (2019). Nature (Journal) Energy Award for the best poster probing energy or charge transfer. AWARDED TO: Christine Lewis, ASU Biodesign Institute, for "Unlocking Efficiency: Dynamic electro-molecular investigations of photosynthetic energy flow."
16. Lewis, Christine (Oct 2019). LAD (legislative Action Days) in Washington D.C. (the Hill) for higher ed legislation for graduate students. Presented and met with staff of Kirsten Sinema, Martha McSally and Rudy Gallego
17. Lewis, Christine (Nov 2019). Nature Conference Functional Dynamics: molecules in motion @ ASU, presented a lightning talk on project.
18. Levi J, Guo S, Kavadiya S, Yin Y, Atkinson AJ, Holman Z, Rittmann BE (2019 Nov 11). Nitrate Reduction By Catalytic Hydrogenation: Controlling Hydrogen Delivery with

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

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

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

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

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



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

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

25. Rittmann BE (2019 July 2). Optimizing Microalgae Production by Delivering Sources of Concentrated CO<sub>2</sub>. IWA Microalgae Conference, Valladolid, Spain.

26. Rittmann BE (2019 July 23). Optimizing Microalgae Production by Delivering Sources of Concentrated CO<sub>2</sub>. Gordon Research Conference on Photosynthesis, Newry, ME

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

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

29. Rittmann BE (2019 November 4). Prying Open the Black Box. Sixth International Conference on Environmental Simulation and Pollution Control, State Key Laboratory on Water Quality, Tsinghua University, Beijing, China.
30. Rittmann BE (2019 November 4). More is Less. Sixth International Conference on Environmental Simulation and Pollution Control, State Key Laboratory on Water Quality, Tsinghua University, Beijing, China
31. Rittmann BE (2019 November 6). Biofilm Processes. Tongji University, Shanghai, China.
32. Rittmann BE (2019 November 8). Ironies of Microbial Ecology. Tongji University, Shanghai, China
49. Saetta D (2019 October 24-25). Urine diversion: Radical change, incremental steps. MIT CEE Rising Stars. Cambridge, MA.\*
50. Scholz M, Daniel T, Biedefeld M, and M Buchanan (2019 08 15). Upcycling Phosphorus for Agricultural Use. Sustainable Phosphorus Webinar Series (online). \*
51. Scholz M, Elser J, Haygarth P, Jarvie H, and R Marshall (2019 11 20). Phosphorus Turns 350! Sustainable Phosphorus Webinar Series (online). \*
52. Scholz M and D Scavia (2019 12 09). Anatomy of a Binational Watershed. Phosphorus Science Now! (online) \*
53. Scholz M and J-O Goyette (2019 09 30). Watershed Buffering Capacity for Phosphorus. Phosphorus Science Now! (online) \*
54. Scholz M (2019 10 01). Phosphorus Sustainability Challenge. US EPA AgSTAR Partner call.\*

## **CONFERENCE / WORKSHOP PARTICIPATION**

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

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

## PATENTS

1. Adams J, Krajmalnik-Brown R, Kang DW, Sadowsky MJ, Khoruts A (2019 Dec 03). Methods for treating autism spectrum disorder and associated symptoms. US Patent App. 16/510,506.
2. Delgado AG, Robles A. The use of microbial chain elongation for treatment of oxidized contaminants. Tech ID M20-034L, submitted 07/29/2019.
3. Eustance E, Rittmann BE, Lai YS, Shesh T, Flory J. 2019. Method and System for Membrane Carbonation (M19-138L)
4. Flory J, Fromme P, Vermaas W, Rittman BE, Torres CI, Moore T, and A Moore (2019 Aug 20). Microbial electro-photosynthesis. US Patent 10,385,304.
5. Parameswaran P, Krajmalnik-Brown R, Popat S, Rittmann BE, and C Torres (2019 Oct 08). Membrane biofilm reactors, systems, and methods for producing organic products. US Patent 10,435,659.

## FUNDED RESEARCH

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



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

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

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

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

## SPIN OUT COMPANIES

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

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

## MENTORING

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

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

## TECH TRANSFER OUTPUTS

[Future H<sub>2</sub>O](#) Engineering Associate and Boyer Lab member Carlos Leyva created an online dashboard for Biodesign C domestic water quality sensors.

<https://io.adafruit.com/cfleyva/dashboards/bdc-floor-1>

<https://io.adafruit.com/cfleyva/dashboards/bdc-floor-2>

<https://io.adafruit.com/cfleyva/dashboards/bdc-floor-3>

<https://io.adafruit.com/cfleyva/dashboards/bdc-floor-4>

<https://io.adafruit.com/cfleyva/dashboards/bdc-floor-5>

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

## POPULAR PRESS COVERAGE

Hall, C (2019 Nov 8). "Science as Type II Fun" Blog Entry,

<https://blogs.egu.eu/divisions/hs/2019/11/08/science-as-type-ii-fun/>

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

Scholz, M (Interviewed by [Grist](#) (publication pending))

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

## WORKSHOPS (HOSTED)

1. Arrowsmith, A (2019 Sep). Risk Assessment Workshop, Arizona State University, Tempe, AZ. To teach how to systematically identify and control hazards to reduce risk of injuries and incidents prior to conducting an experiment for the first time.
2. Hall, C (2019 December 8). American Geophysical Union Student and Early Career Scientist Conference. American Geophysical Union, San Francisco, CA. To provide professional development and networking opportunities for students and early career scientists in the earth and planetary sciences.

3. Hall, C (2019 September 19). Arizona Science Policy Network Science Cafe Series. Tempe, AZ. Discuss mining and groundwater quality with scientists, decision-makers, and the public.
4. Hall, C (2019 September 19). Arizona Science Policy Network Science Cafe Series. Tucson, AZ. Discuss mining and groundwater quality with scientists, decision-makers, and the public.
5. Scholz, M (2019 11 14-15). Phosphorus Field-to-Watershed Modeling Workshop, San Antonio, TX. Convened USDA, academic, and industry researchers developing research on themes related to phosphorus transport through agricultural watersheds.



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

## **SUMMER PROGRAMS/INTERNSHIP PARTICIPATION**

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

## **GRADUATES**

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

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

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

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

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

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

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

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

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

## **JOB PLACEMENTS**

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

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

## VISITING SCHOLARS

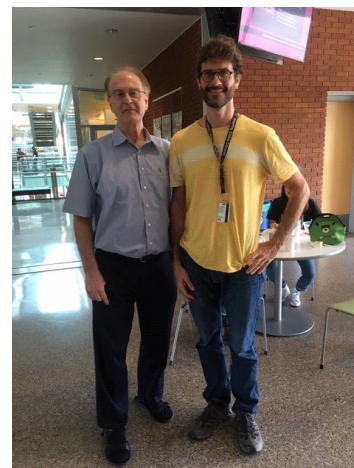
Yuhang Cai, PhD. Harbin Engineering University, China Scholarship Council, Rittmann Lab, 10/04/2019 - 3/31/2021.

Huai Li, Ph.D., Associate Professor, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, NO<sub>x</sub> Bioreduction and Microbial Communities using C<sub>2</sub>H<sub>6</sub> as Sole Electron Donor in a Membrane Biofilm Reactor, Rittmann and Zhou Labs, 10/10/2018 - 10/9/2019.

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

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

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



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

## COURSES DEVELOPED

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

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



## COLLABORATORS

Taylor Davis

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

Carole Flores

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

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

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

Christine Lewis

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

Andrew Marcus

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

Evelyn Miranda

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

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

Srivatsan Mohana Rangan

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

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

Rain Richard

PepsiCo sensor project

Analissa Sarno

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

Matt Scholz

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

## **OUTREACH EVENTS**

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

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

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

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

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

Flores, Carole.

United Way, ASU, Ambassador, October 2019

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

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

Mohana Rangan, Srivatsan.

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

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

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

Rittmann, Bruce.

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

Other Presentations

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

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

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

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

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



## **SERVICE ACTIVITIES**

Anca Delgado

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

Carole Flores

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

Caitlyn Hall

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

Steven Hart

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

Ethan Howley

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

Hannah Ray

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

Bruce Rittmann

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

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

## **ANALYTICAL CAPABILITIES**

Lucas Crane.

Water quality analysis.

Taylor Davis.

Machine learning, learning Tableau software, increased data analytics  
abilities, bland-altman statistical tool

Michael Edgar.

Luminescence, HPLC, NOM analysis.

Christine Lewis.

Origin pro data analysis,

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

### **MICROBIAL METABOLISMS**

Taylor Davis. Fecal Inoculate, mixed composite fecal inoculate, used for inoculation of batch fecal bioreactors to test nitrogen utilization, stored in -80 C freezer on 2nd floor

Christine Lewis. -psbB synechocystis cells are cultured and maintained continually in ISTBV rm 106

### **BIOPROCESSES UPSCALED**

Chenwei Zheng. The project of quaternary ammonium compounds (QAC), including the bioreactors' establishment and process

Yuhang Cai. Anaerobic Biofilm Membrane Bioreactor Model, Pepsico, ASU which includes modeling

Michael Edgar. Upscaled lab-scale slag project to a field-scale demonstration on a farm in Wisconsin for phosphate removal. included bioreactor design, flow design.

Christine Lewis. Electro photo bioreactor fuel cells that we will eventually run with pump probe spectroscopy.

Mark Reynolds. Enhanced methanogenesis in solid waste bioreactor landfill analogues. Funding from the NSF Center for Bio-mediated and Bio-inspired. Sampling from Southwest Regional Landfill (Buckeye, AZ) and Salt River Landfill (Scottsdale, AZ). Other relevant details is 16L working volume in a PVC pipe design. Modeling is desired but has not yet successfully executed.

### **SUSTAINABILITY PRACTICES**

Sarah Arrowsmith. Created and instituted Needles and Sharps Center Specific Training.

Yen-Jung Lai. 1.Reducing energy and chemical demands by managing microalgal membrane properties to enhance the sustainability of microalgal fuels  
2. Mitigate the spreading of antibiotic resistant genes from biological treatment process.

- Christine Lewis. I have taken my project that required considerable waste to almost zero waste by developing fuel cells that do not require plastics and disposables. I have changed my culturing protocols to reduce to less than half of the waste in the past.
- Evelyn Miranda. Reuse of industrial by-product materials (example, spent brewing grains, Sugarcane bagasse, Sugar beet pulp)
- Mark Reynolds. Molecular reagent request. By centralizing requests for reagents on a biweekly basis, this prevents excessive freezer use, minimizing our lab's power needs.
- Matt Scholz. Working with Dr. Rebecca Muenich and team, we have been developing methods for using AI and remote-sensing data to map animal feeding operations across the country, in collaboration with Stanford University, Michigan State, the Environmental Policy and Law Center, and others. Also with Dr. Muenich, we have established a working group called the Phosphorus Transport Modeling Group, which brings together modelers, agronomists, and soil chemists from multiple academic institutes, USDA, and industry to improve the state of phosphorus transport modeling.
- Thiago Stangherlin. I have performed experimentation in tubular reactors using the microalgae strain *scenedesmus* sp. The goal of the experiment is to compare batch reactors with semi-continuous (under different hydraulic retention times), using a low nutrient concentration in order to improve lipid productivity. The experimental results promoted valuable discoveries that will be used to create mathematical models to improve lipid and also protein productivity.

## **SPECIALIZED TRAINING**

Carole Flores

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

Research Administration: Everything You Should Know, Ana Feliciano, Webinar, 9/11/19.

Project MgmtTool Highlight: Wrike, ASU Project Management (PM) Network, 8/13/19.

Sponsored Review - Award Activation Report, ASU, Sarah Kern, 8/13/19.

Intro to Project Management, ASU Project Management Network, 7/30/19.

Empower, Develop, Grow, and Engage (EDGE) Conversations, ASU KE, 7/3/19.

#### Christine Lewis

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

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

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

ASU CLAS Committee

External Affairs Committee

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

Az Science Policy Network Member, Fall 2019 - Present

Collaboration between science experts and legislature.

Preparing Future Faculty, ASU, Fall 2019

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

Andrew Marcus      Mindfulness Leadership Certificate

#### **AWARDS AND PROMOTIONS**

Sarah Arrowsmith      Award for Excellence, Environmental Health and Safety, Nov 14th 2019;  
ASU Laboratory Safety Innovation Award, EH&S, Dec 4th 2019.

Anca Delgado      Special Congressional Recognition by U.S. Senator Martha McSally,  
Arizona, 2019  
Quentin Mees Research Award, AZ Water Association, 2019

Rebecca Dietz      ASU Graduate and Professional Student Association (GPSA),  
Out-of-State Career Development Grant, 2019 September 29

Christine Lewis      Best Poster Presentation at the Nature Conference: Functional Dynamics  
- Visualizing Molecules in Action (see picture, below)

Hannah Ray      Ian C. Watson Fellowship for Membrane Advancement, AMTA,  
2019-2020

Mark Reynolds

SoLS Fall 2019 scholarship | ASU School of Life Sciences

Analissa Sarno

Graduate College Completion Fellowship, Arizona State University  
Graduate College, Fall 2019-Spring 2020

## TESTIMONIALS

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

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

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



Christine Lewis receives Best Poster award.