REINALDO E. ALCALDE

Incoming Tracy Assistant Professor ◇ Civil and Environmental Engineering
The Pennsylvania State University, University Park, PA
rea5465@psu.edu

ACADEMIC APPOINTMENTS AND RESEARCH EXPERIENCE

Tracy Assistant Professor in Environmental Engineering — *Beginning Jan 2027*
The Pennsylvania State University, University Park, PA

Postdoctoral Scholar & NSF Fellow — *Jan 2021 - July 2026*
California Institute of Technology, Pasadena, CA

Graduate Research Assistant & NSF Fellow — *Spring 2015 - Fall 2020*
The University of Texas at Austin, Austin, TX

Visiting Researcher — *Fall 2014*
Pacific Northwest National Laboratory, Richland, WA

Graduate Research Fellow — *Fall 2013 - Fall 2014*
University of Illinois at Urbana-Champaign, Champaign, IL

Undergraduate Researcher
SROP, UCARE, and McNair Undergraduate Research Programs — *Fall 2011 - Summer 2012*
NSF REU, Luleå Tekniska Universitet, Luleå, Sweden — *Summer 2010*

Roadway Design Student Intern — *May 2009 - May 2011*
Nebraska Department of Roads, Lincoln, NE

EDUCATION

The University of Texas at Austin — *Austin, TX*
Ph.D. Environmental Engineering — *Dec 2020*

University of Illinois at Urbana-Champaign — *Champaign, IL*
M.S. Environmental Engineering — *Dec 2014*

University of Nebraska-Lincoln — *Lincoln, NE*
B.S. Civil Engineering *with Honors* — *May 2013*

PUBLICATIONS

17. **Alcalde, R. E.**, Jeckel, H., Zhang, O., Avila, R., Dalleska, N., Mavrodi, D., Yang, C., Newman, D. K. Phosphorus stress and spatial confinement lower the quorum-sensing activation threshold for phenazine production in *Pseudomonas synxantha*, *Current Biology*, 36(13), 3233–3244.e8, 2026. https://doi.org/10.1016/j.cub.2026.05.044

16. Shan, X., Cao, K., Jeckel, H., **Alcalde, R. E.**, Trindade, I., Kwiecinski, J., Newman, D. K. Drought drives elevated antibiotic resistance across soils. *Nature Microbiology*, 11(4), 867–876, 2026. https://doi.org/10.1038/s41564-026-02274-x

15. Cheng, T.-Y., Mukkamala, R. S., **Alcalde, R. E.**, Panahandeh, M., Agarwal, A., Kornfield, J. A., Newman, D. K., Emami, A., A 65nm CMOS hydrogel-based dual fluorescence sensor for bioavailable phosphorus detection. *2026 IEEE International Solid-State Circuits Conference (ISSCC)*, pp. 508–510, 2026. https://doi.org/10.1109/ISSCC49663.2026.11409129

14. Dong, Z., Zhou, H., Cao, R., Zhang, O., Zhao, S., Lyu, P., **Alcalde, R. E.**, Yang, C. Analytic Fourier ptychotomography for aberration-free and high-resolution volumetric refractive index imaging. *Nature Communications*, 17, 727, 2026. https://doi.org/10.1038/s41467-025-67460-7

13. Zhang, O., Zhou, H., Feng, B. Y., Larsson, E. M., **Alcalde, R. E.**, Yin, S., Deng, C., Yang, C. Single-shot volumetric fluorescence imaging with neural fields. *Advanced Photonics*, 7(2), 026001, 2025. https://doi.org/10.1117/1.AP.7.2.026001

12. Esfahani, S. G., **Alcalde, R. E.**, Valocchi, A. J., Sanford, R. A., Werth, C. J. Modeling the Migration and Growth of *Shewanella oneidensis* MR-1 in a Diffusion-Dominated Microfluidic Gradient Chamber Under the Influence of an Antibiotic Concentration Gradient. *Biotechnology and Bioengineering*, 122, 1840–1855, 2025. https://doi.org/10.1002/bit.28991

11. Zhang, O.*, **Alcalde, R. E.***, Zhou, H., Yin, S., Newman, D. K., Yang, C. Investigating 3D microbial community dynamics of the rhizosphere using quantitative phase and fluorescence microscopy. *Proceedings of the National Academy of Sciences*, 121(33), e2403122121, 2024. https://doi.org/10.1073/pnas.2403122121

    *These authors contributed equally.

10. Fouke, B. W., Bhattacharjee, A. S., Fried, G. A., Sivaguru, M., Sanford, R. A., Zhou, L., **Alcalde, R. E.**, Wunch, K., Stephenson, A., Ferrar, J. A., Hernandez, A. G., Wright, C., Fields, C. J., Todorov, L. G., Fouke, K. W., Bailey, C. M., Werth, C. J. Sulfate-Reducing Bacteria Streamers and Iron Sulfides Abruptly Occlude Porosity and Increase Hydraulic Resistance in Proppant-Filled Shale Fractures. *AAPG Bulletin*, 106(1), 179–208, 2022. https://doi.org/10.1306/07132120124

9. **Alcalde, R. E.**, Dundas, C. M., Dong, Y., Sanford, R. A., Keitz, B. K., Fouke, B. W., Werth, C. J. The Role of Chemotaxis and Efflux Pumps on Nitrate Reduction in the Toxic Regions of a Ciprofloxacin Concentration Gradient. *The ISME Journal*, 15(10), 2920–2932, 2021. https://doi.org/10.1038/s41396-021-00975-1

8. Zhou, L., **Alcalde, R. E.**, Deng, J., Zuniga, B., Sanford, R. A., Fouke, B. W., Werth, C. J. Impact of Antibiotic Concentration Gradients on Nitrate Reduction and Antibiotic Resistance in a Microfluidic Gradient Chamber. *Science of the Total Environment*, 779, 146503, 2021. https://doi.org/10.1016/j.scitotenv.2021.146503

7. Deng, J., Zhou, L., Sanford, R. A., Shechtman, L. A., Dong, Y., **Alcalde, R. E.**, Sivaguru, M., Fried, G. A., Werth, C. J., Fouke, B. W.. Adaptive Evolution of *Escherichia coli* to Ciprofloxacin in Controlled Stress Environments: Contrasting Patterns of Resistance in Spatially Varying versus Uniformly Mixed Concentration Conditions. *Environmental Science & Technology*, 53(14), 7996–8005, 2019. https://doi.org/10.1021/acs.est.9b00881

6. Michelson, K., **Alcalde, R. E.**, Sanford, R. A., Valocchi, A. J., Werth, C. J.. Diffusion-Based Recycling of Flavins Allows *Shewanella oneidensis* MR-1 to Yield Energy from Metal Reduction Across Physical Separations. *Environmental Science & Technology*, 53(7), 3480–3487, 2019. https://doi.org/10.1021/acs.est.8b04718

5. **Alcalde, R. E.**, Michelson, K., Zhou, L., Schmitz, E. V., Deng, J., Sanford, R. A., Fouke, B. W., Werth, C. J.. Motility of *Shewanella oneidensis* MR-1 Allows for Nitrate Reduction in the Toxic Region of a Ciprofloxacin Concentration Gradient in a Microfluidic Reactor. *Environmental Science & Technology*, 53(5), 2778–2787, 2019. https://doi.org/10.1021/acs.est.8b04838

4. Sivaguru, M., Saw, J. J., Williams, J. C., Lieske, J. C., Krambeck, A. E., Romero, M. F., Chia, N., Schwaderer, A. L., **Alcalde, R. E.**, Bruce, W. J., Wildman, D. E., Fried, G. A., Werth, C. J., Reeder, R. J., Yau, P. M., Sanford, R. A., Fouke, B. W.. Geobiology reveals how human kidney stones dissolve *in vivo*, *Scientific Reports*, 8, 13731, 2018. https://doi.org/10.1038/s41598-018-31890-9

3. Pruden, A., **Alcalde, R. E.**, Alvarez, P. J. J., Ashbolt, N., Bischel, H., Capiro, N. L., Crossette, E., Frigon, D., Grimes, K., Haas, C. N., Ikuma, K., Kappell, A., LaPara, T., Kimbell, L., Li, M., Li, X., McNamara, P., Seo, Y., Sobsey, M. D., Sozzi, E., Navab-Daneshmand, T., Raskin, L., Riquelme, M.

V., Vikesland, P., Wigginton, K., Zhou, Z.. An Environmental Science and Engineering Framework for Combating Antimicrobial Resistance. *Environmental Engineering Science*, 35(10), 1005–1011, 2018. https://doi.org/10.1089/ees.2017.0520

2. Rowles, L. S., **Alcalde, R.**, Bogolasky, F., Kum, S., Diaz-Arriaga, F. A., Ayres, C., Mikelonis, A. M., Toledo-Flores, L. J., Alonso-Gutiérrez, M. G., Pérez-Flores, M. E., Lawler, D. F., Ward, P. M., Lopez-Cruz, J. Y., Saleh, N. B.. Perceived versus actual water quality: Community studies in rural Oaxaca, Mexico. *Science of the Total Environment*, 622–623, 626–634, 2018. https://doi.org/10.1016/j.scitotenv.2017.11.309

1. **Alcalde, R.** Microbiologically Enhanced Mixing across Scales during in-situ Bioremediation of Uranium. *The McNair Scholars Research Journal*, 2012.

RESEARCH FUNDING AND FELLOWSHIPS

Ideation Grant (Resnick Sustainability Institute award) *February 2025*
Light Sheet Fluorescence Microscope for Rhizosphere Imaging
(lead PI; total award $20,000)

Linde Center (2024 Discovery Funds) *December 2024*
Light Sheet Fluorescence Microscope for Rhizosphere Imaging
(lead PI; total award $25,000)

Center for Environmental Microbial Interactions (2024 Pilot Grant) *September 2024*
Light Sheet Fluorescence Microscope for Rhizosphere Imaging
(lead PI; total award $12,500)

Resnick Sustainability Institute (2022 Impact Grant) *2022*
Monitoring Bioavailable Phosphorus with an Integrated Biosensor and Wireless Reporter System
(project manager; total award $1,300,000)

National Science Foundation Postdoctoral Research Fellowship *2022*
The Role of Phenazines in Regulating Phosphorus Availability in the Rhizosphere
(lead PI; total award $138,000)

EPA P3 Grant *2015*
A Nano-Silver and Zeolite Solution: Ceramic Water Filters for Disinfection and Hardness Removal
(co-I; total award $15,000)

National Science Foundation Graduate Research Fellowship *2015*
Enhancement of Mixing Zones through Microbiological Direct Electron Transfer
(lead PI; total award $96,000 plus tuition)

HONORS AND AWARDS

NSF Postdoctoral Research Fellowships in Biology, NSF PRFB *2022-2024*

Biology and Biological Engineering Divisional Fellowship, Caltech *2021-2022*

NSF-AGEP Research Exchange Retreat Awardee, Stanford and Caltech *Oct 2019, Jan 2020*

American Geophysical Union (AGU) Fall Meeting Travel Award, AGU *December 2019*

Trigg and Fannie E. Twichell Centennial Endowed Presidential Scholarship in Civil Engineering, UT Austin *Fall 2018, Spring 2019*

Professional Development Travel Award, UT Austin *December 2018*

NSF Graduate Research Fellowship Program, NSF GRFP *2015-2018*

Thrust 2000 - W. M. Keck Foundation Endowed Graduate Fellowship in Engineering, UT Austin *2015 - 2018*

Astrobiology Science Conference Travel Award, SETI Institute *June 2015*

Astrobiology Graduate Conference Travel Award, AbGradCon *July 2014*

SURGE Fellowship from College of Engineering, UIUC *2013*

Civil and Environmental Eng. Distinguished Fellowship, UIUC *2013*

Undergraduate Creative Activities and Research Experience (UCARE) Research Scholarship, UNL *2011 - 2013*

Ronald E. McNair Scholar, UNL *2010 - 2013*

Honors Program, UNL *2008 - 2013*

CIC Summer Research Opportunity Scholar (SROP), UNL *Summer 2012*

College of Engineering Dean's List, UNL *2008-2012*

Students United in Classes, Community, Engineering, Service and Study Abroad (SUCCESS) Scholar, UNL *2009 - 2011*

Sweden and France Study Abroad Scholarship *Summer 2010*

Egypt Study Abroad Scholarship *March 2010*

TEACHING EXPERIENCE

Biological Wastewater Treatment and Sludge Processing (CE 385L) *UT Austin*
Teaching Assistant *Fall 2019*
Responsibilities: lab lecturer, grading, office hours
Instructor: Dr. Manish Kumar

Design of Wastewater and Water Treatment Facilities (CE 364) *UT Austin*
Teaching Assistant *Spring 2018*
Responsibilities: lab lecturer, grading, office hours
Instructor: Dr. Charles J. Werth

Supervised Teaching in Civil Engineering (CE 398T) *UT Austin*
Completed Course *Spring 2019*

Environmental Engineering Freshmen Seminar (EVE 101) *UT Austin*
Guest Lecturer *October 2017*
Responsibilities: Class lecture and field sampling on water quality

Extremophiles - A Journey from Life Origins to Astrobiology *Modelo, Merida, YU, MX*
Instructor, Clubes de Ciencia Mexico *August 2017*
Responsibilities: Designed and lectured a nine-day course for Latinx undergraduate students

Introduction to Environmental Engineering (BSEN 326) *UNL*
Teaching Assistant *Spring 2011*
Responsibilities: Grading homework and exams
Instructor: Dr. Xu Li

MENTORING

Graduate Student Rotation Mentor at Caltech:

Raj S. Mukkamala - Chemical Engineering *Spring 2023*

Jarek V. Kwiecinski - Geological and Planetary Sciences *Fall 2022*

Undergraduate Student Mentor at Caltech:

Rogelio Avila - Genomics, visiting, Apatzingán, MX, WAVE program *Summer 2024*

Madison Ochoa - Biology, WAVE program *Summer 2022*

Undergraduate Student Mentoring at UT Austin:

Yuriko Aguilar Corona - Biotechnology Engineering, visiting, Guadalajara, MX *Summer 2019*

Nubia Rocío Quevedo - Environmental Engineering, visiting, Bogota, CO *Summer 2019*

Tlalli Vargas Martinez - Environmental Engineering *Summer 2019*
Emily Schmitz - Chemical Engineering *Fall 2017 - Fall 2018*
Tzatzilt Cruz Bernal - Environmental Engineering, visiting, Oaxaca, MX *Summer 2018*
Judy Hellmich - Environmental Sciences *Fall 2016 - Fall 2017*

Clean Water Science Network's Virtual Mentorship Program:

Luis Carrasco Soledispa - Engineering in Water Sciences, Tena, EC *Fall 2020 - Summer 2021*
Yuriko Aguilar Corona - Biotechnology Engineering, Guadalajara, MX *Fall 2018 - Summer 2019*
Mariana Alvarado Caamal - Biotechnology Engineering, Merida, MX *Fall 2017 - Summer 2018*

INVITED PRESENTATIONS

8. **Alcalde, R. E.** "Towards the Precision Farming Revolution: In-Situ Soil Nutrient Biosensors," Resnick Sustainability Institute Seminar Series. California Institute of Technology, Pasadena, CA. December 2024. *(oral)*
7. **Alcalde, R. E.** and Zhang, O., "Exploring the Rhizosphere: Visualizing Microbial Interactions for Agricultural Innovation," Environment and Sustainability Breakfast Exchange. California Institute of Technology, Pasadena, CA. October 2024. *(oral)*
6. **Alcalde, R. E.** "AgroBioLink: The Phosphorus Sensor Project," The Rocket Fund 2024 Showcase. California Institute of Technology, Pasadena, CA. June 2024. *(oral)*
5. **Alcalde, R. E.** "Towards the Precision Farming Revolution: In-Situ Soil Nutrient Biosensors," Geoclub Seminar Series. California Institute of Technology, Pasadena, CA. March 2024. *(oral)*
4. **Alcalde, R. E.**, Newman, D. K. "Towards field-deployable in-situ real-time whole-cell biosensors," Keck Workshop: Managing Soil Organic Carbon for Climate Change Mitigation . Pasadena, CA. August 2023. *(poster)*
3. **Alcalde, R. E.** "Microfluidics for Modeling Antibiotic Resistance," AEESP AJAR Future Faculty Seminar Series, Online presented from Pasadena, CA. February 2021. *(oral)*
2. **Alcalde, R. E.**, Werth C.J. "Chemical & Energy Requirements for Microbial Life," UT Pop-Up Institute: Understanding Planetary Habitability. Austin, TX. June 2018. *(oral)*
1. **Alcalde, R. E.**, Zhou L., Deng, Y., Sanford R.A., Fouke B.W., Werth C.J. "Effects of *S. oneidensis* MR-1 Motility on Nitrate Biodegradation Along a Concentration Gradient of the Antibiotic Ciprofloxacin in a Diffusion-Controlled Microfluidic Gradient Chamber," UNL Environmental and Water Resource Engineering Graduate Seminar. Lincoln, NE. March 2018. *(oral)*

CONFERENCE PRESENTATIONS

† *indicates the presenting author*

18. **Alcalde, R. E.**†, Newman, D. K., "Phosphorus stress reshapes metabolic interactions in structured soil-like habitats," EMBO-EMBL Symposium, Metabolic interactions shape ecosystems, Heidelberg, Germany. July 2026. *(oral)*
17. **Alcalde, R. E.**†, Zhang, O., Jeckel, H., Avila, R., Yang C., Newman, D. K., "Environmental Cues and Quorum Sensing: Phosphorus Limitation Induces AHL Production in *Pseudomonas synxantha*," 2025 ASM Microbe conference, Los Angeles, CA. June 2025. *(poster)*
16. **Alcalde, R. E.**†, Newman, D. K., "The role of phenazines in regulating phosphate bioavailability in the rhizosphere," 2023 SACNAS National Diversity Conference in STEM, Portland, OR. October 2023. *(oral)*

15. **Alcalde, R. E.**†, Newman, D. K., "Innovative approaches for sustainable crop agriculture: Using bacteria to promote nutrient acquisition and monitoring," American Chemical Society Fall 2023, San Francisco, CA. August 2023. *(oral)*

14. **Alcalde, R. E.**†, Newman, D. K., "The role of phenazines in regulating phosphate bioavailability in the rhizosphere," International Phytobiomes Conference 2022, Denver, CO. September 2022. *(oral)*

13. **Alcalde, R. E.**†, Zhou, L., Werth, C. J., "The War Between Microbes and Antibiotics: Phenotypic Responses that Allow Metabolic Activity for Nitrate Reduction under Continuously Varying Antibiotic Concentrations in a Microfluidic Reactor," American Geophysical Union Fall Meeting 2019, San Francisco, CA. December 2019. *(poster)*

12. **Alcalde, R. E.**†, Michelson, K, Zhou, L., Schmitz, E.V., Deng, J., Sanford, R. A. Fouke, B.W., Werth, C. J., "Pore-Scale Effects of Antibiotic Pollution on Microbial Growth, Function, and Contaminant Degradation in Subsurface Environments," NSF AGEP Research Exchange, Stanford, CA. October 2019. *(oral)*

11. **Alcalde, R. E.**†, Murry, D., Werth, C. J., "A Modeling Approach to Assess the Feasibility of Water Injection," TCEQ Environmental Trade Fair & Conference, Austin, TX. May 2019. *(oral)*

10. Kum, S.†, Rowles L.S., **Alcalde, R. E.**, Diaz, F., Mikelonis, A., Lawler, D., "Preparing for water-related graduate school in the United States: Online mentorship in water education for students from underserved communities" Abstracts of Papers of the American Chemical Society, Washington D.C. March 2019. *(oral)*

9. **Alcalde, R. E.**†, Michelson, K, Zhou, L., Schmitz, E.V., Deng, J., Sanford, R. A. Fouke, B.W., Werth, C. J., "Bacterial Motility and Spatial Heterogeneity Enhances Biological Nitrate Reduction in the Presence of Toxic Antibiotic Concentrations," American Geophysical Union Fall Meeting 2018. Washington, D.C. December 2018. *(oral)*

8. **Alcalde, R. E.**†, Zhou L., Deng, J., Dong, Y., Sanford R.A., Fouke B.W., Werth C.J. "Physiological Response of *Shewanella oneidensis* MR-1 to Spatial Gradients of Ciprofloxacin Concentration," 255th American Chemical Society National Meeting & Exposition. New Orleans, LA. March 2018. *(oral)*

7. **Alcalde, R. E.**†, Zhou L., Deng, J., Dong, Y., Sanford R.A., Fouke B.W., Werth C.J. "Physiological Response of Nitrate Reducing Microorganisms to Steep Antibiotic Concentration Gradients," Association of Environmental Engineering and Science Professors 2017 Conference. Ann Arbor, MI. June 2017. *(poster)*

6. Rowles III, L.S.†, **Alcalde, R. E.**†, Haugland J.O., Martinez, S., Rodriguez, N., Lawler, D.F., Saleh, N.B., "A Nano-Silver and Zeolite Solution: Ceramic Water Filters for Disinfection and Hardness Removal," Tech Connect World Innovation Conference and Expo, National Harbor, MD. May 2017. *(poster)*

5. **Alcalde, R. E.**, Zhou L., Deng, J., Dong, Y., Sanford, R. A.†, Fouke B.W., Werth, C. J., "Physiological Response of Nitrate Reducing Microorganisms to Steep Antibiotic Concentration Gradients," The Geological Society of America, North-Central Section, 50th Annual Meeting, April 2016. *(oral)*

4. **Alcalde, R. E.**†, L. Zhou, I.K.O. Cann, R.I. Mackie, T.W. Wietsma, M. Oostrom, R.A. Sanford, B.W. Fouke, C.J. Werth. "Culturing Methanogenic Archaea in Controlled Stress Micro-Environments," Astrobiology Science Conference 2015, Chicago, IL. June 2015. *(oral)*

3. **Alcalde, R. E.**†, Zhou, L., Cann, I.K.O., Sanford, R. A., Fouke, B.W., Werth, C. J., "Understanding Stress-Induced Microbial Evolutionary Mechanisms via Microfluidic Cells," Astrobiology Graduate Conference 2014, Troy, NY. July 2014. *(poster)*

2. **Alcalde, R. E.**†, Michelson, K., Werth C.J., "Microbiologically Enhanced Mixing Across Scales during *In-Situ* Bioremediation of Uranium," Illinois Summer Research Symposium, Champaign, IL. July 2012. *(poster)*
Received Outstanding Poster Award

1. **Alcalde, R. E.**†, "Case Study: Velocity and Discharge Measurements in a Combined Weir and Sluice Gate Structure," Berkeley McNair Research Symposium, Berkeley, CA. August 2011. *(oral)*

SERVICE AND LEADERSHIP

Co-Director, Treasurer, and Mentor - Clean Water Science Network 501(c)(3) non-profit organization - www.cleanwaterscience.org — *Fall 2017 - present*

Member - AGU Voices for Science, Policy track — *April 2019 - March 2020*

Participant - AGU 2019 Congressional Visits, Washington D.C. — *April 2019*

Organizer/Educator - Water Quality Workshop, Del Valle, TX over 200 Del Valle High School students — *May 2018*

Instructor - Clubes de Ciencia Mexico, Merida, MX — *August 2017*

Organizer/Educator - NSF NUE Water Quality Workshop, Oaxaca, Mexico — *February 2017*

Organizer/Educator - EPA P3 Water Quality Workshop, Oaxaca, Mexico — *October 2016*

Program Committee Co-Chair - ESS Research Symposium, UIUC — *Fall 2013 - Spring 2014*

Vice President - Chi Epsilon, Civil Engineering Honor Society, UNL — *Fall 2011 - Spring 2012*

Family Relations Leader - Dance Marathon, UNL — *Fall 2010 - Spring 2011*

Operations Officer - The Big Event, UNL — *Fall 2009 - Spring 2011*

Mentor - Nebraska Achievement Scholars, UNL — *Fall 2009 - Spring 2010*

Mentor - Engineering Peer Mentor, UNL — *Fall 2010*

Mentor - Lincoln TeamMates Mentor, UNL — *Fall 2009 - Fall 2010*

MEDIA COVERAGE

Getting to the root of the rhizosphere, *PNAS Science Sessions*, *link* — *August 2026*

Stressed-Out Soil Bacteria Adapt to Environmental Conditions, *The Caltech Weekly*, *link* — *June 2026*

Observing Soil Bacterial Ecosystems, *Science, In Other Journals*, *link* — *September 2024*

New Technology Images Microbes in 3D, *The Caltech Weekly*, *link* — *September 2024*

The Roots of the Matter, *Caltech Magazine*, *link* — *Spring 2024*

PROFESSIONAL MEMBERSHIPS AND CREDENTIALS

Member, American Society for Microbiology — *Since 2024*

Member, American Geophysical Union — *Since 2018*

Member, American Chemical Society — *Since 2018*

Engineer in Training (EIT) — *2013*