

Devin A. Bowes, Ph.D.

Department of Environmental Health Sciences
Arnold School of Public Health
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Columbia, SC, USA

EDUCATION

- 2022 **Ph.D. Biological Design**
School for Engineering of Matter, Transport, and Energy
Ira A. Fulton Schools of Engineering
Arizona State University, Tempe, AZ, USA
Dissertation: Novel Applications of Wastewater-based Epidemiology for Assessing Population Nutrition, Infectious Disease, and Chronic Illness
- 2014 **Bachelor of Science, Nutrition & Dietetics**
Department of Nutrition
West Chester University of Pennsylvania, West Chester, PA, USA
Summa Cum Laude

ACADEMIC APPOINTMENTS

- 2023-Present **Assistant Professor**, Department of Environmental Health Sciences, Arnold School of Public Health, The University of South Carolina, Columbia, SC, USA
- 2023 **Postdoctoral Associate**, Center on Forced Displacement, Boston University, Boston, MA, USA
- 2022 **Postdoctoral Research Scholar**, The Biodesign Institute, Arizona State University, Tempe, AZ, USA
- 2021-2022 **Graduate Research Assistant**, Biodesign Center for Health Through Microbiomes, The Biodesign Institute, Arizona State University, Tempe, AZ, USA
- 2018-2021 **Graduate Research Assistant**, Biodesign Center for Environmental Health Engineering, The Biodesign Institute, Arizona State University, Tempe, AZ, USA

TEACHING EXPERIENCE

- 2019 – 2020 **Co-Instructor**, *Biological Design Graduate Program Seminar* (BDE598), School for the Engineering of Matter, Transport, and Energy, Ira A. Fulton Schools of Engineering. This 1-credit course is offered to graduate and undergraduate honors students interested in learning about transdisciplinary research approaches within the scope of Biological Design.

AWARDS AND HONORS

- 2022 Ira A. Fulton Schools of Engineering Convocation Hooding Ceremony Graduate Student Speaker; May 11th, 2022
- 2021 Dean's Dissertation Award, Ira A. Fulton Schools of Engineering, Arizona State University
- 2021 University Graduate Fellowship, School for Engineering of Matter, Transport, and Energy
- 2020 P.E.O. Scholar Award (AV Chapter) Nominee
- 2020 Biodesign Virtual Travel Grant Award Recipient
- 2020 Certificate of Excellence for Outstanding Graduate Student Research in Biological Design
- 2019 Achievement Reward for College Scientists (ARCS) Scholar Award Finalist, Phoenix Chapter
- 2019 Biodesign Travel Grant Award Recipient
- 2019 ASU SUN Award for promoting ASU during a tour hosting Northern Arizona University (NAU) RISE students
- 2019 Top ten finalist: American Society for Nutrition: Nutrition 2019 Conference; *Emerging Leaders in Nutrition Science Poster Competition for Nutritional Epidemiology*
- 2019 Biodesign Fusion 2019 Scientific Retreat: Louis Pasteur Award for *Most Global Impact*.
- 2019 Biodesign Travel Grant Award Recipient

SERVICE

- 2023 AEESP Student Poster Judge, AEESP 2023 June 20-23, Boston, MA
- 2023 Symposium Co-Chair, *Implementing Wastewater-Based Epidemiology as a Community-Centric, Noninvasive Tool for Population-Level Monitoring*. International Society of Exposure Science (ISES) Annual Meeting. Chicago, IL
- 2023 Co-Organizer, Workshop on Ethics in Wastewater-based Epidemiology, AEESP, Boston MA
- 2022-2023 Co-Associate Guest Editor, Special Issue: *Wastewater-based Epidemiology to Assess Environmentally Influenced Disease*. Journal of Exposure Science and Environmental Epidemiology
- 2022 Co-Creator of Biological Design Graduate Program Seminar Series
- 2022 American Chemical Society (ACS) Environmental Chemistry Division Certificate of Merit Award Judge: ACS Fall Meeting 2022, Chicago, IL (in person)
- 2022 Abstract Reviewer for International Society for Exposure Science (ISES) Fall Meeting, Lisbon, Portugal (virtual)
- 2022 Poster Judge for ASU SOLS 29th Annual Undergraduate Research Symposium (in person)
- 2022 Abstract Reviewer for American Public Health Association (APHA) Fall Meeting, Boston, MA (virtual)
- 2022 Executive Board Member, Haven Analytics
- 2020 - 2022 Biological Design Graduate & Alumni Affairs Committee Member
- 2019 – 2021 Co-Founder, OneWaterOneHealth Non-profit Project, ASU Foundation, Tempe, AZ
- 2019 Hosted Tour of ASU for NAU RISE Undergraduate and Graduate Students

2019 – 2021 Biodesign Center for Environmental Health Engineering Laboratory Safety Officer
2018 – 2021 Biodesign Center for Environmental Health Engineering Laboratory Undergraduate
Mentor and Graduate Student Lead

PEER-REVIEWED PUBLICATIONS (Published and in-press; *authors contributed equally)

1. **Bowes, D.A.***, Darling, A.*, Driver, E.M.*, Kaya, D.*, Maal-Bared, R.*, Lee, L.M., Goodman, K., Adhikari, S., Aggarwal, S., Bivins, A., Bohrerova, Z., Cohen, A., Duvallet, C., Elnimeiry, R.A., Hutchison, J.M., Kapoor, V., Keenum, I., Ling, F., Sills, D., Tiwari, A., Vikesland, P., Ziels, R., Mansfeldt, C. Structured ethical guidelines for wastewater-based surveillance. *Environmental Science & Technology (Article ASAP)*. 23 August 2023. DOI: 10.1021/acs.est.3c04529
2. **Bowes, D.A.***, Henke, K.H.*, Driver, E.M., Newell, M.E., Block, I., Schaffer, G., Varsani, A., Scotch, M., Halden, R.U. Enhanced detection of mpox virus in wastewater using a pre-amplification approach: A pilot study informing population-level monitoring of low-titer pathogens. *The Science of the Total Environment*. 11 August 2023 (online). <https://doi.org/10.1016/j.scitotenv.2023.166230>
3. Mansfeldt, C., Maal-Bared, R., Kaya, D., **Bowes, D.A.**, Keenum, I., Sils, D., Aggarwal, S., Tiwari, A., Hutchinson, J.M. Unveiling the targeted opportunities and universal challenges of wastewater-based surveillance for public health. *Environmental Science & Technology: Water*. 21 June 2023. DOI: 10.1021/acsestwater.3c00291
4. **Bowes, D.A.**, Driver, E.M., Savic, S., Chen, Q., Whisner, C.M., Krajmalnik-Brown, R., Halden, R.U. Integrating multiomic wastewater-based epidemiology into public health nutrition assessment to elucidate population-level dietary behavior. *Nature Food*. 13 March 2023. <https://doi.org/10.1038/s43016-023-00717-w>.
5. **Bowes, D.A.***, Driver, E.M.*, S. Kraberger, Fontenele, R.S., Holland, L.A., Wright, J., Johnston, B., Savic, S., Newell, M.E., Adhikari, S., Kumar, R., Goetz, H., Binsfeld, A., Nessi, K., Watkins, P., Mahant, A., Zevitz, J., Deitrick, S., Brown, P., Dalton, R., Garcia, C., Inchausti, R., Holmes, W., Tian, X.J., Varsani, A., Lim, E.S., Scotch, M., Halden, R.U. Leveraging an established neighbourhood-level, open access wastewater monitoring network to address public health priorities: a population-based study. *The Lancet Microbe*. 6 December 2022. [https://doi.org/10.1016/S2666-5247\(22\)00289-0](https://doi.org/10.1016/S2666-5247(22)00289-0)
6. Amin, V.*, **Bowes, D.A.***, Halden, R.U. Systematic scoping review evaluating the potential of wastewater-based epidemiology for monitoring cardiovascular disease and cancer. *Sci Total Environ*. 9 November 2022. <https://doi.org/10.1016/j.scitotenv.2022.160103>
7. Mohr, A.E., Jasbi, P., **Bowes, D.A.**, Dirks, B., Whisner, C.M., Arciero, K.M., Poe, M., Gumprich, E., Sweazea, K.L., Arciero, P.J. Differential effects of one versus two-day intermittent fasting protocols on the gut microbiome and plasma metabolome of adults with overweight/obesity. *Frontiers in Nutrition*. 2022 October 26. <https://doi.org/10.3389/fnut.2022.1036080>
8. Adhikari S., Kumar R., Driver E.M., **Bowes D.A.**, Ng K.T., Sosa-Hernandez J.E., Oyervides-Muñoz M.A., Melchor-Martínez E.M., Martínez-Ruiz M., Coronado-Apodaca K.G., Smith T., Bhatnagar A., Piper B.J., McCall K.L., Parra-Saldivar R., Barron L.P., Halden R.U. Occurrence of Z-drugs, benzodiazepines, and ketamine in wastewater in the United States and Mexico during the Covid-19 pandemic. *Sci Total Environ*. 2022 Oct 12:159351. doi: 10.1016/j.scitotenv.2022.159351.

9. Sosa-Hernández, J.E., Oyervides-Muñoz, M.A., Melchor-Martínez, E.M., Driver, E. M., **Bowes, D.A.**, Kraberger, S., Lucero-Saucedo, S.L., Fontenele, R.S., Parra-Arroyo, L., Holland, L.A., Peña-Benavides, S.A., Newell, M.E., Martínez-Ruiz, M., Adhikari, S., Rodas-Zuluaga, L. I., Kumar, R., López-Pacheco, I.Y., Castillo-Zacarias, C., Iqbal, H.M.N., Lim, E.S., Salas-Limón, D., Varsani, A., Halden, R.U., Parra-Saldívar, R. Extensive Wastewater-Based Epidemiology as a Resourceful Tool for SARS-CoV-2 Surveillance in a Low-Middle Income Country Through a Successful Collaborative Quest: WBE, Mobility, and Clinical Tests. *Water*. 2022 June 8.
10. Driver E.M., Gushgari A.J., Steele J.C., **Bowes D.A.**, Halden R.U. Assessing population-level stress through glucocorticoid hormone monitoring in wastewater. *Sci Total Environ*. 2022 May 16:155961. doi: 10.1016/j.scitotenv.2022.155961.
11. Faleye T.O.C., Driver E.M., **Bowes D.A.**, Holm R.H., Talley D., Yeager R., Bhatnagar A., Smith T., Varsani A., Halden R.U., Scotch M. Detection of Human, Porcine and Canine Picornaviruses in Municipal Sewage Sludge Using Pan-Enterovirus Amplicon-based Long-read Illumina Sequencing. *Emerging Microbes and Infections*. doi: 10.1080/22221751.2022.2071173.
12. **Bowes D.A.**, Driver E.M., Halden R.U. A framework for wastewater sample collection from a sewage cleanout to inform building-scale wastewater-based epidemiology studies. *Sci Total Environ*. doi: 10.1016/j.scitotenv.2022.155576.
13. Driver E.M., **Bowes D.A.**, Halden R.U., Conroy-Ben O. Implementing wastewater monitoring on American Indian reservations to assess community health indicators. *Sci Total Environ*. doi: 10.1016/j.scitotenv.2022.153882.
14. Wright, J.W., Driver, E.M., **Bowes, D.A.**, Johnston, B.J., Halden, R.U. (2022) Comparison of high-frequency in-pipe SARS-CoV-2 wastewater-based surveillance to concurrent COVID-19 random clinical testing on a public U.S. university campus. *Sci Total Environ*. doi: 10.1016/j.scitotenv.2021.152877.
15. Faleye, T.O.C., **Bowes, D.A.**, Driver, E.M., Adhikari, S., Adams, D., Varsani, A., Halden, R.U., Scotch, M. (2021). Wastewater-Based epidemiology and long-read sequencing to identify enterovirus circulation in three municipalities in maricopa county, arizona, southwest united states between June and October 2020. *Viruses*. 13, 1803. <https://doi.org/10.3390/v13091803>
16. Fontenele, R. S., Kraberger, S., Hadfield, J., Driver, E. M., **Bowes, D.A.**, Holland, L. A., Faleye, T., Adhikari, S., Kumar, R., Inchausti, R., Holmes, W. K., Deitrick, S., Brown, P., Duty, D., Smith, T., Bhatnagar, A., Yeager, R. A., 2nd, Holm, R. H., von Reitzenstein, N. H., Wheeler, E., Dixon, K., Constantine, T., Wilson, M.A., Lim, E.S., Jiang, X., Halden, R.U., Scotch, M., Varsani, A. (2021). High-throughput sequencing of SARS-CoV-2 in wastewater provides insights into circulating variants. *Water research*, 205, 117710. <https://doi.org/10.1016/j.watres.2021.117710>
17. Faleye T.O.C., Driver E.M., **Bowes D.A.**, Adhikari S, Adams D, Varsani A, Halden RU, Scotch M. Pan-Enterovirus Amplicon-Based High-Throughput Sequencing Detects the Complete Capsid of a EVA71 Genotype C1 Variant via Wastewater-Based Epidemiology in Arizona. *Viruses*. 2021; 13(1):74.
18. Choi P.M., **Bowes D.A.**, O'Brien J.W., Li J., Halden R.U., Jiang G., Thomas K.V., Mueller J.F. Do food and stress biomarkers work for wastewater-based epidemiology? A critical evaluation. *Sci Total Environ*. 736 (2020). doi: 10.1016/j.scitotenv.2020.139654
19. **Bowes D.A.**, Halden R.U. Theoretical evaluation of using wastewater-based epidemiology to assess the nutritional status of human populations. *Current Opinion in Environmental Science & Health*. 9 (2019): 58-63. doi: 10.1016/j.coesh.2019.05.001

20. **Bowes, D.A.**, Halden, R.U. Breast Cancer and Dietary Intake of Endocrine Disruptors: A Review of Recent Literature. *Current Pathobiology Reports* 7, 41–46 (2019). doi: 10.1007/s40139-019-00199-1

PUBLICATIONS UNDER REVIEW/REVISION/SUBMITTED (*authors contributed equally)

1. Faleye, T.O.C., Driver, E.M., **Bowes, D.A.**, Smith, A., Kaiser, N.A., Wright, J.W., Chapman, A.R., Halden, R.U., Varsani, A., Scotch, M. Canine Parvovirus 2C identified in dog feces from poop bags collected from outdoor waste bins in Arizona USA, June 2022. (Under Revision)
2. **Bowes, D.A.**, Zaman, M.H. Considerations for conducting wastewater-based public health assessments in migrant populations. (Under Review)

BOOK CHAPTERS (PEER-REVIEWED) (*authors contributed equally)

1. Driver, E. M.*, **Bowes, D. A.***, Halden R. U. Chapter 9: Expansion and diversification of wastewater-based epidemiology strategies in pandemic conditions to serve immediate public health goals. *Wastewater-based Epidemiology for the Assessment of Human Exposure to Environmental Pollutants*. 4 August 2023. <https://doi.org/10.1016/B978-0-443-19172-5.00015-9>

PREPRINT (*authors contributed equally)

1. Nirmalkar, K., Patel, J., Kang, D.W., Bellinghiere, A., **Bowes, D.A.**, Adams, J.B., Krajmalnik-Brown, R. (2023) Bimodal distribution of candida albicans in children with autism linked with ASD symptoms. *bioRxiv: the preprint server for biology*. <https://doi.org/10.1101/2023.07.13.548908>
2. **Bowes, D.A.***, Darling, A.*, Driver, E.M.*, Kaya, D.*, Maal-Bared, R.*, Lee, L.M., Goodman, K., Adhikari, S., Aggarwal, S., Bivins, A., Bohrerova, Z., Cohen, A., Duvallet, C., Elnimeiry, R.A., Hutchison, J.M., Kapoor, V., Keenum, I., Ling, F., Sills, D., Tiwari, A., Vikesland, P., Ziels, R., Mansfeldt, C. (2023) Structured Ethical Review for Wastewater-based Testing. *medRxiv: the preprint server for health sciences*. <https://doi.org/10.1101/2023.06.12.23291231>
3. **Bowes, D.A.***, Driver, E.M.*, S. Kraberger, Fontenele, R.S., Holland, L.A., Wright, J., Johnston, B., Savic, S., Newell, M.E., Adhikari, S., Kumar, R., Goetz, H., Binsfeld, A., Nessi, K., Watkins, P., Mahant, A., Zevitz, J., Deitrick, S., Brown, P., Dalton, R., Garcia, C., Inchausti, R., Holmes, W., Tian, X.J., Varsani, A., Lim, E.S., Scotch, M., Halden, R.U. (2021) Unrestricted online sharing of high-frequency, high-resolution data on SARS-CoV-2 in wastewater to inform the COVID-19 public health response in Greater Tempe, Arizona. *medRxiv: the preprint server for health sciences*. <https://doi.org/10.1101/2021.07.29.21261338>

CONFERENCE PROCEEDINGS/PAPERS/PRESENTATIONS

1. Driver, E. M. & **Bowes, D. A.** Applications in Wastewater-based Epidemiology. National Environmental Health Association 2023 Annual Educational Conference (AEC) & Exhibition. New Orleans, LA, July 31–August 3, 2023.

2. **Bowes, D. A.**, Driver, E. M., Halden, R. U. Evaluating the Feasibility of Wastewater-based Epidemiology to Assess Population-level Meat Consumption. The American Society for Nutrition, Boston, MA. July 22-25, 2023.
3. **Bowes, D. A.**, Driver, E. M., Savic S., Cheng, Q., Whisner, C. M., Krajmalnik-Brown, R., Halden, R. U. Integrated multiomic wastewater-based epidemiology can elucidate population-level dietary behaviour and inform public health nutrition assessments. Testing the Waters, Oxford, UK, June 26-27, 2023.
4. Driver, E. M., **Bowes, D. A.**, Henke, K., Rathnam, R., Newell, M. E., Babbrah, A., Halden, R. Modeling the Feasibility of Measuring Novel Synthetic Opioids in Wastewater to Assess the Evolving Opioid Epidemic in the US. Association of Environmental Engineering & Science Professors (AEESP) Annual Conference. Boston, MA, June 21-22, 2023.
5. Rathnam, R., Babbrah, A., Newell, M. E., Henke, K., Driver, E. M., **Bowes, D. A.**, Halden, R. U. Exploring the correlation between anthropogenic contamination, methylation variation, and adverse health effects in olfactory bulb tissues. Society of Environmental Toxicology and Chemistry (SETAC) Europe 33rd Annual Meeting, Dublin Ireland. April 30-May 4, 2023.
6. Babbrah, A., Rathnam, R., Newell, M. E., Henke, K., Driver, E. M., **Bowes, D. A.**, Halden, R. U. Detection and quantification of micro- and nanoplastics in olfactory bulb tissue: A neurodegenerative disease association study. Society of Environmental Toxicology and Chemistry (SETAC) Europe 33rd Annual Meeting, Dublin Ireland. April 30-May 4, 2023.
7. Newell, M. E., Babbrah, A., Rathnam, R., Aravinda, A., Driver, E. M., **Bowes, D. A.**, Henke, K., Halden, R. U. Comparing neurodegenerative disease prevalence rates and sewage sludge heavy metals in the United States (2017-2022). Society of Environmental Toxicology and Chemistry (SETAC) Europe 33rd Annual Meeting, Dublin Ireland. April 30-May 4, 2023.
8. **Bowes, D.A.**, Driver, E.M., Henke, K. Wastewater-based epidemiology (WBE) through various applications related to human and environmental health. 2022 AZ Virtual Sanitarians' Conference. Arizona, November 2nd. 2022.
9. **Bowes, D.A.**, Driver, E.M., Savic, S., Cheng, Q., Whisner, C., Krajmalnik-Brown, R., Halden, R.U. Integrating wastewater-based epidemiology into the public health nutrition framework. Arizona Postdoctoral Research Conference. University of Arizona, Tucson, AZ, September 22nd, 2022.
10. Driver, E. M., Joseph, C., Menchú-Maldonado, M., Novoa, D., **Bowes, D. A.**, Denetdale, M., Lane, T., Bennon, B., Muenich, R., Hamilton, K., Halden, R. U., Conroy-Ben, O. Discussions on Creating Tribal Capacity for Implementing Wastewater-Based Epidemiology. American Chemical Society (ACS) Fall Meeting, Chicago, IL, August 21-25, 2022.
11. **Bowes, D.A.**, Driver, E.M., Savic, S., Cheng, Q., Whisner, C., Krajmalnik-Brown, R., Halden, R.U. Multidisciplinary approaches and considerations for integrating wastewater-based epidemiology into the public health nutrition framework. American Chemical Society (ACS) Fall Meeting; Chicago, IL, August 21-25, 2022
12. Kumar, R., Adhikari, S., Driver E. M., **Bowes, D.A.**, Ng, K.T., Sosa-Hernandez, J.E., Smith, T., Bhatnagar, A., Parra-Saldivar, R., Barron, L.P., Halden, R.U. Trends of prescription and illicit drug consumption in the USA and Mexico during the COVID-19 pandemic determined by wastewater-based epidemiology. American Chemical Society (ACS) Spring Meeting; San Diego, CA, March 20-24
13. Driver, E.M., Biyani, N., **Bowes, D. A.**, Perleberg, T., Yanez, A., Joseph, C., Denetdale, M., Halden, R. U. & O. Conroy-Ben. Wastewater monitoring to track SARS-CoV-2 levels. 2021 Navajo Research Conference, Flagstaff, AZ, October 20-21, 2021.

14. Fontenele, R. S., S., Kraberger, J. Hadfield, E. M. Driver, **Bowes, D.A.**, L. A. Holland, T. O. C. Faleye, S. Adhikari, R. Kumar, R. Inchausti, W. K. Holmes, S. Deitrick, P. Brown, D. Duty, T. Smith, A. Bhatnagar, R. A. Yeager II, R. H. Holm, N. Hoogesteijn von Reitzenstein, E. Wheeler, K. Dixon, T. Constantine, M. A. Wilson, E. S. Lim, X. Jiang, R. U. Halden, M. Scotch, A. Varsani. High-throughput sequencing of SARS-CoV-2 in wastewater provides insights into circulating variants. American Medical Informatics Association Annual Symposium. San Diego, CA, October 30-November 3, 2021.
15. Adhikari, S., K. R. Kumar, E. M. Driver, **Bowes, D.A.**, K. T. Ng, J. E. Sosa-Hernandez, T. Smith, A. Bhatnagar, R. Parra-Saldivar, L. P. Barron, and R. U. Halden. Occurrence of Z-drugs and Antidepressants in Wastewater during the COVID-19 Global Pandemic in the United States and Mexico, American Public Health Association (APHA) Annual Meeting, Virtual, October 24-27, 2021.
16. Faleye, T. O. C., **Bowes, D.A.**, E. M. Driver, S. Adhikari, D. Adams, A. Varsani, R. U. Halden, and M. Scotch, M. Preponderance of Enterovirus C Circulation In Three Municipalities In Maricopa County, Arizona, Southwest United States Between June And October 2020. World Microbiome Forum, Federation of European Microbiological Societies (FEMS) and the American Society of Microbiology (ASM), Virtual, June 20-24, 2021.
17. Adhikari, S., K. R. Kumar, E. M. Driver, **Bowes, D.A.**, K. T. Ng, J. E. Sosa-Hernandez, T. Smith, A. Bhatnagar, R. Parra-Saldivar, L. P. Barron, R. U. and Halden. Estimating the Prevalence of Z-drugs and Antidepressants in Wastewater During the COVID-19 Global Pandemic in the United States and Mexico. Biodesign Fusion Scientific Retreat, Tempe, AZ, April 9, 2021.
18. Adhikari, S., K. R. Kumar, E. M. Driver, **Bowes, D.A.**, K. T. Ng, J. E. Sosa-Hernandez, T. Smith, A. Bhatnagar, R. Parra-Saldivar, L. P. Barron, R. U. and Halden. Estimating the Prevalence of Z-drugs and Antidepressants in Wastewater During the COVID-19 Global Pandemic in the United States and Mexico. 11th Annual Graduate Poster Symposium, School of Sustainable Engineering and the Built Environment, Arizona State University, Virtual, February 19, 2021.
19. **Bowes, D. A.**, E. M. Driver et al. The Future of Population-Level Emerging Infectious Disease Monitoring: SARS-CoV-2 Surveillance in Wastewater as an Early Warning Signal for COVID-19 Presence in Communities. Arizona Bioscience Week, Arizona Bioindustry Association (AZBio), Virtual, September 13-19, 2020.
20. **Bowes, D. A.**, Driver, E.M., and Halden, R.U. Changes in Dietary Patterns and Associated Human Behaviors in Southwestern US Municipal Wastewater During the COVID-19 Global Pandemic. 258th American Chemical Society (ACS) National Meeting, Virtual, August 17-20, 2020.
21. **Bowes, D.A.**, Driver, E.M., Halden, R.U. Near Real-Time Methods and Applications for Assessing Environmental Quality and Public Health. Arizona Environmental Health Association Annual Meeting, Phoenix, AZ, March 11-12, 2020.
22. Steele, J. C., **Bowes, D.A.**, E. M. Driver and R. U. Halden. Using Participatory Research to Develop an Online WBE Dashboard to Address the United States Opioid Epidemic. Testing the Waters. 4th International Conference on Wastewater Analysis. Guangzhou, China, October 29-November 1, 2019.
23. **Bowes, D. A.**, E. M. Driver and R. U Halden. Identification and Analysis of Wastewater-Borne Human Nutritional Biomarkers to Assess Population Nutritional Status. Testing the Waters. 4th International Conference on Wastewater Analysis. Guangzhou, China, October 29-November 1, 2019.
24. **Bowes, D. A.**, E. M. Driver, S. Adhikari, M. Meir and R. U. Halden. Testing the Waters, Foshan, China; Poster: Integrating Wastewater-based Epidemiology into Adolescent Education to Improve

Community Health. Testing the Waters. 4th International Conference on Wastewater Analysis. Guangzhou, China, October 29-November 1, 2019.

25. Driver, E. M., **Bowes, D.A.**, R. U. Halden. Piping in New Information on Population Health. Arizona Well-being Commons Conference. Phoenix, AZ, September 27, 2019.
26. Driver E. M., **Bowes, D.A.**, A. J. Gushgari and R. U. Halden. New methods in wastewater-based epidemiology: Plant-based dietary trends and in situ active sample collection. 257th American Chemical Society (ACS) National Meeting, San Diego, CA, August 25-29, 2019.
27. **Bowes, D.A.**, R.U. Halden. Dietary Intake of Estrogen-Mimicking Endocrine Disruptors and Breast Cancer. 257th American Chemical Society (ACS) National Meeting, San Diego, CA, August 25-29, 2019.
28. **Bowes, D. A.**, E. M. Driver and R. U. Halden. Presentation: Identification and Analysis of Human Nutritional Biomarkers Utilizing Wastewater-based Epidemiology. American Society for Nutrition (ASN), Baltimore, MD, June 8-11, 2019.
29. **Bowes, D. A.**, E. M. Driver and R. U. Halden. Poster: Identification and Analysis of Human Nutritional Biomarkers Utilizing Wastewater-based Epidemiology. American Society for Nutrition (ASN), Baltimore, MD, June 8-11, 2019.
30. **Bowes, D.A.**, R.U. Halden. Poster: Endocrine Disrupting Dietary Components and Breast Cancer: A Review. Association of Environmental Engineering & Science Professors (AEESP) Annual Conference. Tempe, AZ, May 14-16, 2019.
31. Driver E. M., J. C. Steele, A. J. Gushgari, **D. A. Bowes**, V. P. Kelkar and R. U. Halden Longitudinal Assessment of Opioid Consumption in Tempe, Arizona by Wastewater-based Epidemiology. Biodesign Fusion Scientific Retreat, Phoenix, AZ. March 22, 2019 (Louis Pasteur Award for Most Global Impact).

INNOVATION: PROVISIONAL AND/OR PENDING PATENT APPLICATIONS

1. Integrated multi-omic wastewater-based epidemiology into public health nutrition assessment to elucidate population-level dietary behavior. US provisional patent application, No. 63/509,748
2. Simultaneous quantification of 13 anions using ion chromatography and suppressed conductivity detection for industrial, environmental, and human health applications. U.S. provisional patent application No.: 63/401,407
3. Colorectal cancer epigenetic biomarkers for liquid biopsy. U.S. provisional patent application No.: 63/397,333
4. Urinary protein biomarkers related to cardiovascular disease and cancer and uses thereof. U.S. provisional patent application No.: 63/381,279

MENTORSHIP

Former Graduate Students:

2023 N.G., Materials Science Engineering, Boston University

Former Undergraduate Students:

- 2021 – 2022 C.F., Biomedical Sciences, Barrett, The Honors College
- 2021 – 2022 M.M., Biological Sciences, Barrett, The Honors College
- 2021 – 2022 N.C., Biological Sciences, Barrett, The Honors College
- 2021 – 2022 J.N., Biochemistry, Barrett, The Honors College (Committee Member) *Thesis: Assessing the Potential to Determine Diabetes Prevalence at the Community-Level Using Wastewater-Based Epidemiology*
- 2021 – 2022 D.J., Biochemistry, Barrett, The Honors College (Committee Member) *Thesis: Assessing the Potential to Determine Diabetes Prevalence at the Community-Level Using Wastewater-Based Epidemiology*
- 2020 – 2021 A.M., Biomedical Sciences, Barrett, The Honors College
- 2020 – 2021 J.Z., Biological Sciences, Barrett, The Honors College
- 2020 B.J., Chemistry, Barrett, The Honors College
- 2020 P.W., Chemical Engineering, Barrett, The Honors College
- 2020 K.N., Medical Microbiology, Barrett, The Honors College
- 2019 – 2022 S.S., Biological Sciences (Conservation Biology and Ecology), Barrett, The Honors College
- 2019 – 2020 J.W., Biological Sciences, Barrett, The Honors College
Thesis: Comparison of high-frequency, in-pipe SARS-CoV-2 wastewater-based surveillance to concurrent COVID-19 random clinical testing on a public U.S. university campus
- 2019 – 2020 V.A., Biomedical Sciences, Barrett, The Honors College (Committee Member)
Thesis: Examining the role of biomarkers in community sewage to track the top deadly diseases in the United States
- 2019 – 2020 A.B., Biochemistry, Barrett, The Honors College
- 2018 – 2020 A.C., Chemical Engineering, Barrett, The Honors College
Thesis: Narcotics consumption trends at a southwestern U.S. university campus in 2017 to 2018 tracked by wastewater-based epidemiology
- 2018 – 2020 K.C., Biological Sciences, Barrett, The Honors College
Thesis: Monitoring the rise in methamphetamine use amidst the opioid epidemic in 2 U.S. cities via wastewater-based epidemiology

INVITED TALKS/WEBINARS/SEMINARS & MEDIA

- Arizona Horizons PBS Invited Interview on Wastewater-based Epidemiology for human health monitoring. Live interview on February 6th, 2023. <https://azpbs.org/horizon/2023/02/recent-findings-in-covid-wastewater/>
- ASU Prep Digital Webinar Spring Series. Title: *Assessing the potential of wastewater-based epidemiology to understand population-level dynamics of dietary behavior*
- Biological Design Spring Seminar Series guest lecturer. Title: *Assessing the potential of wastewater-based epidemiology to understand population-level dynamics of dietary behavior*
- Webinar series hosted by NSF-funded Research Collaborative Network. Title: *Wastewater Monitoring for SARS-CoV-2 to Support Underserved Populations* (10/2020)
- ASU Agricultural Webinar Series. Title: *Wastewater-based Epidemiology to Understand Population-level Dietary Trends* (09/2020)
- INSPIRE: A two-day summer camp encouraging Native American students to apply for college. Title: *Wastewater-based Epidemiology: A Near Real-Time Method to Support Data-Driven*

Decisions (06/2020)

- BASIS High School senior students at the Biodesign Institute. Title: *Wastewater-based Epidemiology to Assess Population Nutritional Status. (06/2020)*

PROFESSIONAL MEMBERSHIPS

- American Public Health Association (APHA)
- International Society of Exposure Science (ISES)
- American Society for Microbiology (ASM)
- American Association for the Advancement of Science (AAAS)
- American Chemical Society (ACS)
- American Society for Nutrition (ASN)

PROFESSIONAL CERTIFICATIONS

- American Red Cross CPR/AED for Professional Rescuers with First Aid (2021-2023)
- National Academy of Sports Medicine (NASM) Certified Personal Trainer (2017-2020)
- Harvard Medical School Trending Topics in Internal Medicine: Fecal Microbiota Transplantation for the Treatment of Recurrent Clostridium Difficile Infections. Certificate of attendance (2021)

PEER REVIEW ACTIVITY

- Aquaculture
- Chemosphere
- Science of the Total Environment
- Environmental Science & Technology
- Environment International
- Journal of Exposure Science and Environmental Epidemiology
- Water Research

COMMUNITY OUTREACH AND VOLUNTEERING

- Author of monthly wellness articles for The Biodesign Institute at Arizona State University (2021-2022)
- Nutrition Teacher at William T. Machan School (2020)
- Arizona Science Policy Network (AZSPN) (2020)
- Biodesign Center for Environmental Health Engineering Page Manager (2019-2020)