Joseph E. Weaver

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Education and Employment

2021-Present	NSF Postdoctoral Fellow In Biology Newcastle University, UK Host: Prof. Thomas P. Curtis
2021	Doctor of Philosophy in Civil Engineering Minor in Biotechnology North Carolina State University Advisors: Prof. Francis L. de los Reyes III, Prof. Joel J. Ducoste
2013	Master of Science, Environmental Engineering North Carolina State University Advisor: Prof. Morton A. Barlaz
2002-2011	Software Engineer Sonalysts Incorporated
2002	Bachelor of Science, Electrical Engineering Cornell University

Fellowships and Awards

2021	Postdoctoral Research Fellowship in Biology, National Science Foundation. NSF Award 2007151.
2020	W. Wesley Eckenfelder Graduate Research Award for 2020 from the American Academy of Environmental Engineers.
2017	Fellow, Microbial Biotechnology Training Program, Graduate Assistance in Areas of National Need. US Department of Education GAANN Award P200A140020

Travel Grants

2023	Federation of European Microbiological Societies, travel to FEMS 2023
2022	International Society for Microbial Ecology, travel award to ISME18.
2019	NCSU College of Engineering Travel Award. Covering travel to the IWA MEWE 2019 Conference, Hiroshima.
2019	NCSU Graduate Student Association Travel Award. Covering travel to the IWA MEWE 2019 Conference, Hiroshima.

Poster Awards

2021 Runner-up, *Modeling environmental bioreactors treating wastewater by integrating biological processes, floc microenvironments, and computational fluid dynamics.* EB Network Early Career Researcher Conference.

2017 3rd place poster, *What's Driving Microbial Community Assembly in Full-Scale Wastewater Treatment?* NC-AWWA-WEA Annual Conference, Raleigh, NC

2014 1st place poster, *Effect of Variable Shear on the Formation of Aerobic Granules in an Eccentric Couette Micro-reactor*. CCEE WREE Annual Symposium, Raleigh, NC

2012 2nd place poster, *Anaerobic biodegradability of plastics in laboratory-scale landfill reactors*. Global Waste Management Symposium, Phoenix, AZ

Publications

1. Weaver, JE. (2023) Quantifying drift-selection balance using an agent-based biofilm model of identical heterotrophs under low nutrient conditions. **Royal Society Interface Focus**. *In press.*

2. Weaver, JE. (2021) From Floc to Reactor Scales: A Multi-Faceted Investigation Integrating Microbial Ecological Experiments and Computational Modeling to Understand Aerobic Wastewater Systems. Under the direction of de los Reyes III, F.L., Ducoste, J.J., Call, D.E., and Goller, C.G. **PhD Dissertation**, North Carolina State University, Raleigh, NC.

3. Wu, L., Ning, D., Zhang, B., Li, Y., Zhang, P., Shan, X., Zhang, Q., Brown, M.R., Li, Z., Van Nostrand, J.D., Ling, F., Xiao, N., Zhang, Y., Vierheilig, J., Wells, G.F., Yang, Y., Deng, Y., Tu, Q., Wang, A., Acevedo, D., Agullo-Barcelo, M., Andersen, G.L., de Araujo, J.C., Boehnke, K.F., Bond, P., Bott, C.B., Bovio, P., Brewster, R.K., Bux, F., Cabezas, A., Cabrol, L., Chen, S., Etchebehere, C., Ford, A., Frigon, D., Gómez, J.S., Griffin, J.S., Gu, A.Z., Habagil, M., Hale, L., Hardeman, S.D., Harmon, M., Horn, H., Hu, Z., Jauffur, S., Johnson, D.R., Keucken, A., Kumari, S., Leal, C.D., Lebrun, L.A., Lee, J., Lee, M., Lee, Z.M.P., Li, M., Li, X., Liu, Y., Luthy, R.G., Mendonça-Hagler, L.C., de Menezes, F.G.R., Meyers, A.J., Mohebbi, A., Noyola, A., Oehmen, A., Palmer, A., Parameswaran, P., Park, J., Patsch, D., Reginatto, V., de los Reyes, F.L., Rossetti, S., Sidhu, J., Sloan, W.T., Smith, K., de Sousa, O.V., Stephens, K., Tian, R., Tooker, N.B., De los Cobos Vasconcelos, D., Wakelin, S., Wang, B., *Weaver, J.E.*, West, S., Wilmes, P., Woo, S-G., Wu, J-H., Wu, L., Xi, C., Xu, M., Yan, T., Yang, M., Young, M., Yue, H., Zhang, Q., Zhang, W., Zhang, Y., Zhou, H., Zhang, T., He, Z., Keller, J., Nielsen, P.H., Alvarez, P.J.J., Criddle, C.S., Wagner, M., Tiedje, J.M., He, Q., Curtis, T.P., Stahl, D.A., Alvarez-Cohen, L., Rittmann, B.E., Wen, X. and Zhou, J. (2019) Global diversity and biogeography of bacterial communities in wastewater treatment plants. **Nature Microbiology** 4, 1183–1195 doi:10.1038/s41564-019-0426-5

4. *Weaver, J.E*., Wang, L., de los Reyes III, F.L., and Barlaz, M.A (2019) Systems and Methods for Studying Microbial Processes and Communities in Landfills. in **Understanding Terrestrial Microbial Communities** Hurst, CJ ed. Springer ISBN:978-3-030-10777-2

5. *Weaver, J.E.*, Williams, J.C., Ducoste, J.J., and de los Reyes III, F.L. (2019) Measuring the Shape and Size of Activated Sludge Particles Immobilized in Agar with an Open Source Software Pipeline. **Journal of Visualized Experiments** v143, e58963. doi:10.3791/58963

6. *Weaver, J.E.,* Hong, H., Ducoste, J.J., and de los Reyes III, F.L. (2018) Controlling aerobic biological floc size using Couette-Taylor bioreactors. **Water Research** v147, pp 177-183. doi:10.1016/j.watres.2018.09.060

7. *Weaver, J.E.*, Ducoste, J.J., and de los Reyes III, F.L. (2016) Fluid shear variation potentially plays a role in aerobic granular sludge formation. **Proceedings of the Water Environment Federation**, WEFTEC 2016, v2016 i11 pp 5737-5744. doi:10.2175/193864716819706734

8. de los Reyes III, F.L., *Weaver, J.E.* and Wang, L. (2015) A methodological framework for linking bioreactor function to microbial communities and environmental conditions. **Current Opinion in Biotechnology** v33, pp 112-118. doi:10.1016/j.copbio.2015.02.002

9. *Weaver, J.E.*, (2013) Effect of Inoculum Source on the Rate and Extent of Anaerobic Biodegradation Under the direction of Barlaz, M.A., and de los Reyes III, F.L. **MS Thesis**, North Carolina State University, Raleigh, NC.

In Submission

1. *Weaver, J.E*., Zuliani, P., Chen, J., McGough S., Li, B., Allen, B., Ofiţeru, I.D., Wipat, A., Davenport, R., Swailes, D., Curtis, T.P. (2022) Accelerating Environmental Bioreactor Design: Why your car and phone are getting better faster than your sewage works and anaerobic digester. **Environmental Science and Technology** (viewpoint)

2. Haq, A., Malik, A., Khan, A., *Weaver, J.E.*, Wang,L., Khan, H., Khan, S., Shah, A.A., Ahmed, S., de los Reyes III, F.L., Badshah, M. (2022) Effect of removal of inhibitors on microbial communities and biogas yield of *Jatropha curcas* during continuous anaerobic digestion. **Renewable and Sustainable Energy Reviews**

In Prep

1. *Weaver, J.E.,* de los Reyes III, F.L., and Ducoste, J.J. A combined CFD-Biokinetic Model of Aerobic Wastewater Treatment Using and Open Source Pipeline

2. *Weaver, J.E.,* Ducoste, J.J., and de los Reyes III Microbial Community Assembly of Two Full Scale Wastewater Treatment Plants with Initially Identical Populations

Presentations, Invited Seminars, and Conference Invitations

Presented or Scheduled

1. Weaver, J.E. (2023) Undertanding the balance between drift and selection in biofilm formation using agent-based biofilm modelling. **Association of Environmental Engineering Scientists and Professors (AEESP) Conference 2023**. Boston, US.

2. Weaver, J.E. (2023) “Illuminating the balance between drift and kinetics in biofilm formation using an agent-based model to manipulate luck.” **Federation of European Microbiological Societies (FEMS) Conference 2023**. Hamburg, Germany

3. Weaver, J.E. (2022) “Fit or just luck? Using agent-based biofilm models to quantify the selection advantage required to overcome negative selection via random drift.” **1St Annual Microbiology Oylmpiad Symposium**, Newcastle, UK

4. Weaver, J.E. (2021) “Drift Matters, Until it Doesn’t: Quantifying the Fitness Advantage Necessary to Overcome Negative Drift Selection using an Agent-Based Model of Spatially Competing Heterotrophic Bacteria”, **9th IWA Microbial Ecology and Water Engineering Specialist Conference (MEWE2021),** Delft, Netherlands. (presented virtually)

5. Weaver, J.E., de los Reyes III, F.L. and *Ducoste J.J.* (2021) “Implementing a Single Modeling Approach that Combines Computational Fluid Dynamics (CFD), Biokinetics, Micro-floc Scale Diffusion, and Particle Sizes.” **WEFTEC,** Chicago IL. n.b. Ducoste presented on Weaver’s behalf due to conference schedule conflicts

6. *Weaver, J.E.,* and de los Reyes III, F.L. (2019). “Microbial Community Assembly in Two Full Scale Aerobic Basins Containing Identical Starting Populations: Drivers and Implications”, **8th IWA Microbial Ecology and Water Engineering Specialist Conference (MEWE2019)**, Hiroshima, Japan.

7. *Weaver, J.E.,* de los Reyes III, F.L. and Ducoste, J.J. (2016) “Inducing aerobic granular sludge formation through unevenly distributed hydrodynamic shear rates.” **NC AWWA-WEA**, Raleigh, NC.

8. *Weaver, J.E.,* de los Reyes III, F.L. and Ducoste, J.J. (2016) “Fluid shear variation potentially plays a role in aerobic granular sludge formation.” **WEFTEC**, New Orleans, LA.

9. *Weaver, J.E.,* and Barlaz, M.A. (2015) “Effect of Inoculum source on the rate and extent of anaerobic biodegradation.” **A&WMA National Conference**, Raleigh, NC.

Invited Seminars and Conferences

1. *Weaver, J.E.* (2022) “Inferring Drift Prevalence Using Agent-Based Biofilm Models and Its Implications in Environmental Biotechnology” **Les Ecologistes Seminar Series, Simon Fraser University**, Burnaby, CA (presented remotely)

2. *Weaver, J.E.* (2021) “From Floc to Reactor Scales: A Multi-Faceted Investigation Integrating Microbial Ecological Experiments and Computational Modeling to Understand Aerobic Wastewater Systems.” **Environmental Engineering Research Group Seminar Series, Newcastle University**, Newcastle UK

3. *Microbial ecology for engineering biology (2022),* the Theo Murphy international scientific meeting of **The Royal Society,** Buckinghamshire UK.

As co-author

1. *Mcgough S.A.,* Fuentes-Cabrera M., Sakkos J., Taniguchi D., Maheshwari K., Zuliani P., Weaver J., Ducat D., Li B., Birnsheed A., Somnath S., and Curtis,T.P. “A Deep Learning HPC Agent-Based Modeling Framework: Applications to Microbiology” (2021) **eScience2021** (online)

Teaching and Mentoring

Pedagogical Training

2022	Data and Software Carpentries Instructor Training Program
2019	Completed the NCSU Teaching and Communication Certificate.

Teaching Assistant

Spr. 2021	Environmental Biotechnology	*(CE 774)*
Spr. 2019	Senior Design Project	*(CE 481)*
Spr. 2019	Environmental Biotechnology	*(CE 774)*
Fall 2019	Water Supply and Wastewater Systems	*(CE 484)*
Spr. 2018	Global WASH	*(CE 497/596)*
Fall 2017	Water Supply and Wastewater Systems	*(CE 484)*
Fall 2014	Biological Principles of Environmental Engineering	*(CE 573)*

Guest Lectures and Labs

Spring 2023	Efficiently conducting a literature review	*(CEG 8110)*
Spring 2023	Introduction to coding in Python	*(CEG 8110)*

Spring 2023	Solving wastewater design problems via Python	*(CEG 8104)*
Spring 2015 thru Fall 2018	Metagenomics: Ordination and data visualization	*(BIT 495/477/577)*
Falls 2014 -2017	Environmental chemistry and microbiology: Identifying problem organisms in wastewater via microscopy.	*(CE 378)*

Internal Workshops Organized

2022	*Peer and Expert MSc Oral Defense Feedback Session*, Newcastle University Environmental Engineering MSc Program
2022	*Performing an Effective Literature Search,* Newcastle University Environmental Engineering MSc Professional Development, special workshop
2022	*Constructing an Individual Development Plan* Newcastle Environmental Engineering Early Career Researcher Development
2014	*Laziness, Levers, and Literature. How to search and manage the literature.* NCSU CCEE Department Seminar.

Formal Mentoring Positions

2023 – present	PhD Co-Supervisor to Xiaoqi Yu, working title Spatio-temporal Antimicrobial Resistance (AMR) Patterns in Catchments and AMR Attenuation within Green Infrastructure’
2023 - present	MSc Supervisor to Hongze Li, working title ‘Screening competition between bacteria relevant to environmental biotechnology’
2022	MSc Supervisor to Xiaoqi Yu, ‘Creation of a Pairwise Interaction Database of Antibacterial Type VI Secretion Systems’
2016 – 2018 (Summers)	Research Internship Summer Experience (RISE) Program. Responsible for training and mentoring undergraduate researchers while they performed their own summer research culminating in poster presentation.
2017	Formed and coordinated graduate cohort written prelim study group.
2013	Graduated student mentor to Ally Patrick, *Thermal Acclimation of Mesophilic Inocula for Thermophilic Biochemical Methane Potential Tests.* NCSU Spring Undergraduate Research Symposium.

Community and Service

Peer Review

2013 - 2023	Articles reviewed for: *Water Science & Technology*, *Waste Management*, *Journal of Environmental Engineering, and others*

Service

2019-Present	Postgrad member of invited seminar committee
2019-2020	Lab group representative, Environmental Engineering Lab Condition and Safety Committee
2019	Invited panel member, “Tell It Like It Is”: Teaching Assistant Discussion Panel for the NCSU campus-wide New TA workshop
2015	Chair, program committee. NCSU CCEE WREE Graduate Research Symposium.

Outreach

2017–2018	Girl Scouts of America Engineering Day.
2013–2016	Boy Scouts of America Engineering Merit Badge Day.

Grant Writing

As Primary Investigator or Fellow

2019 Weaver, Joseph E*. Individual Based Modelling of Chemically Mediated Microbial Interactions in Biofilms.* NSF-Postdoctoral Research Fellowship in Biology **(Awarded NSF 2007151, $276,000)**

2014 Weaver, Joseph E. “Microbial Biotechnology Training Program, Graduate Assistance in Areas of National Need.” US Department of Education **(Awarded DoE GANN P200A140020, $98,000)**

As mentor for undergraduate research

2013 Weaver, Joseph E., Patrick, Ally *Thermal Acclimation of Mesosphilic Inocula for Thermophilic Biochemical Methane Potential Tests*. **(Awarded $750)**

As contributing writer

2022 Zuliani, P., Li, B., and Curtis, T.P. *NUFEB: Microbial Communities Simulation for the (Biologists) Masses* EPSRC

2021 Zuliani, P, Li. B., Allen, B., and Curtis, T.P. *BIOHPC: Simulating Microbial Communities on High-Performance Computers* EPSRC IAA **(Awarded £50,000)**

2021 Curtis, T.P., Allen, B., and Zuliani, P.*Accelerating Innovation By Designing Water Treatment Biofilm Media in silico.* NBIC PoC **(Awarded £50,000)**

2017 de los Reyes III, Francis L. and Ducoste, Joel J. *Using Microbial Ecology Theory to Understand Microbial Community Dynamics and Improve Function of Anaerobic Bioreactors.* NSF. **(Awarded $327,000)**

2017 de los Reyes III, Francis L. *Understanding substrate-community interactions to develop resilient anaerobic digestion of food waste* EREF. **(Awarded $155,000)**

2016 de los Reyes III, Francis L. and Ducoste, Joel J. *Microbial ecology theory as a framework for understanding and improving anaerobic co-digestion.* NSF.

Professional Development

Certificates

2022	EBNET Metabolic Modelling (competitive application process)
2019	NCSU Teaching and Communication Certificate

Fellowship: Microbial Biotechnology Training Program, US Department of Education Graduate Assistance in Areas of National Need

2016	Capstone Semester Seminar
2016	Professional Development Semester Seminar
2015	Research Ethics Seminar

Pedagogy

2017	Introduction to Teaching
2017	Responding to Student Writing
2017	Teaching Portfolio
2017	Avoiding Death by PowerPoint
2017	How to Engage with Diverse Learning Styles
2017	Managing Conflict in the Classroom
2017	Teaching Assistant Orientation Symposium
2017	Moodle Essentials
2015	AEESP Case Studies in Project Based Learning

Grant Writing

2019	Semester mini-course on grant identification, drafting, and submission
2018	Broadening the Impacts of Your Research