

# Kathryn L. Langenfeld

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## EDUCATION AND TRAINING

<b>Postdoc</b>	<i>Ecology &amp; Evolutionary Biology, University of Michigan</i>	2024
	<u>Advisors:</u> Dr. Melissa Duhaime & Dr. Krista Wigginton	
<b>Postdoc</b>	<i>Environmental Engineering &amp; Earth System Science, Stanford University</i>	2024
	<u>Advisors:</u> Dr. Alexandria Boehm & Dr. Christopher Francis	
<b>Ph.D.</b>	<i>Environmental Engineering, University of Michigan</i>	2022
	<u>Advisors:</u> Dr. Krista Wigginton & Dr. Melissa Duhaime	
<b>M.S.E.</b>	<i>Environmental Engineering, University of Michigan</i>	2018
<b>B.S.E.</b>	<i>Civil Engineering, University of Iowa</i>	2016
<b>B.S.</b>	<i>Mathematics, University of Iowa</i>	2016

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## RESEARCH

### **Human Respiratory Emission Biomarker Identification** 2024-Present

*Dr. Melissa Duhaime and Dr. Krista Wigginton, University of Michigan*

- Identifying bacteriophage biomarkers of human respiratory emissions from existing metagenomes to improve studies surveying the presence of influenza
- Creating new PCR assays to identify the presence of human respiratory emissions in indoor environments
- **Role: Postdoctoral Researcher**

### **Stinson Beach Aquifer Transect Biogeochemical Cycling** 2022-2024

*Dr. Alexandria Boehm and Dr. Christopher Francis, Stanford University*

- Conducted spatial and temporal collection of the beach aquifer pore water
- Analyzed metadata and microbiomes (16S rRNA sequencing, metagenomics, metatranscriptomics)
- **Role: Postdoctoral Researcher**

### **Wastewater Viral Community Dynamics Using Quantitative Metagenomics** 2016-2022

*Dr. Krista Wigginton and Dr. Melissa Duhaime, University of Michigan*

- Determined optimal viral concentration and purification methods from wastewater
- Developed a quantitative metagenomic method and bioinformatic pipeline
- Assessed how the viral community alters through wastewater treatment
- Found that few, highly abundant viral populations are conserved and replicate during wastewater treatment
- **Role: Doctoral Student Researcher**

**Impact of Phage-Host Coevolution on Emergence of Antibiotic Resistance** 2018-2022

*Dr. Luis Zaman, University of Michigan*

- Created *in silico* Avida environments to simulate antibiotics and antibiotic resistance
- Conducted Avida experiments to understand how phage-host coevolution impacts the evolution and emergence of antibiotic resistance
- Phage-host coevolution accelerates the emergence of antibiotic resistance and occasionally has pleiotropic effects where decreased susceptibility to phage infection also reduces susceptibility to antibiotics
- **Role: Doctoral Student Researcher**

**Rhizosphere Bioremediation of Munition Explosives** 2013-2016

*Dr. Craig Just, University of Iowa*

- **Role: Undergraduate Student Researcher**

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## PUBLICATIONS

### Peer-Reviewed Journal Articles

1. Hegarty, B., Riddell, J., Bastien, E., Langenfeld, K., Lindback, M., Saini, J., Wing, A., Zhang, J., Duhaime, M. (2024) Benchmarking informatics approaches for virus discovery: caution is needed when combining *in silico* identification methods, *mSystems*, e01105-23. *Impact Factor: 6.40*
2. **Langenfeld, K.**, Chin, K., Wigginton, K., Duhaime, M. (2021) Comparison of ultrafiltration and iron chloride flocculation in the preparation of aquatic viromes from contrasting sample types, *PeerJ*, 9:e11111. *Impact Factor: 3.06*
3. Crossette, E., Gumm, J., **Langenfeld, K.**, Raskin, L., Duhaime, M., Wigginton, K. (2021) Metagenomic quantification of genes with internal standards, *mBio*, 12(1), e03173-20. *Impact Factor: 6.78*
4. Arehart, J., **Langenfeld, K.**, Gingerich, E. (2020) Reevaluating traditional international service-learning during a global pandemic, *Advances in Engineering Education*, 8(4), n4. *Impact Factor: 1.30*
5. Graham, K., Loeb, S., Wolfe, M., Catoe, D., Sinnott-Armstrong, N., Kim, S., Yamahara, K., Sassoubre, L., Mendoza, L., Roldan, L., Li, L., **Langenfeld, K.**, Wigginton, K., Boehm, A. (2020) SARS-CoV-2 RNA in wastewater settled solids is associated with COVID-19 cases in a large urban sewershed, *Environmental Science & Technology*, 55(1), 488-498. *Impact Factor: 11.36*
6. Rockey, N., Arts, P., Li, L., Harrison, K., **Langenfeld, K.**, Fitzsimmons, W., Lauring, A., Love, N., Kaye, K., Raskin, L., Roberts, W., Hegarty, B., Wigginton, K. R. (2020). Humidity and deposition solution play a critical role in virus inactivation by heat treatment on N95 respirators, *mSphere*, 5:e00588-20. *Impact Factor: 4.39*
7. Petrovich, M. L., Zilberman, A., Kaplan, A., Eliraz, G., Wang, Y., **Langenfeld, K.**, Duhaime, M. B., Wigginton, K. R., Poretsky, R. S., Avisar, D., Wells, G. F. (2020). Microbial and Viral Communities and their Antibiotic Resistance Genes throughout a

Hospital Wastewater Treatment System. *Frontiers in Microbiology*, 11, 153. *Impact Factor: 5.64*

8. Bril, J. S., **Langenfeld, K.**, Just, C. L., Spak, S. N., & Newton, T. J. (2017). Simulated mussel mortality thresholds as a function of mussel biomass and nutrient loading. *PeerJ*, 5, e2838. *Impact Factor: 3.06*
9. Schroer, H. W., **Langenfeld, K.**, Li, X., Lehmler, H. J., & Just, C. L. (2017). Biotransformation of 2, 4-dinitroanisole by a fungal *Penicillium* sp. *Biodegradation*, 28(1), 95-109. *Impact Factor: 3.91*
10. Schroer, H. W., **Langenfeld, K.**, Li, X., Lehmler, H. J., & Just, C. L. (2015). Stable Isotope-Enabled Pathway Elucidation of 2, 4-Dinitroanisole Metabolized by *Rhizobium litchii*. *Environmental Science & Technology Letters*, 2(12), 362-366. *Impact Factor: 7.65*

### **Conference Proceedings**

1. Arehart, J., **Langenfeld, K.**, Kreiger, B. (2021). Engagement in Practice: Pedestrian Bridges as Engineering Service-Learning Projects. In *2021 ASEE Annual Conference & Exposition* (p. 1). American Society for Engineering Education.
2. Oliver, J. P., Schueler, J., Hurst, J., Crossette, E., **Langenfeld, K.**, Gooch, C., ... & Sassoubre, L. (2017). Antibiotics and antibiotic resistant bacteria and genes in northeastern dairy manure management systems—Project overview and preliminary findings from an 11 farm case study. In *2017 ASABE Annual International Meeting* (p. 1). American Society of Agricultural and Biological Engineers.

### **Manuscripts in Review**

1. **Langenfeld, K.**, Hegarty, B., Vidaurri, S., Crossette, E., Wigginton, K., Duhaime, M. (2024). A quantitative metagenomic approach to determine population concentrations with examination of quantitative limitations, *Nucleic Acids Research*, in review. *Impact Factor: 19.16*
2. **Langenfeld, K.**, Kreiger, B., Arehart, J. (2024). Training Global Engineers through Pedestrian Bridge Service-Learning Projects, *Journal of Civil Engineering Education*, in review. *Impact Factor: 2.27*

### **Manuscripts in Preparation**

1. **Langenfeld, K.**, Hegarty, B., Duhaime, M., Wigginton, K. (2024). Viral community dynamics through wastewater demonstrates biological treatment alters community functional potential, *ES&T*, in prep. *Impact Factor: 11.33*
2. **Langenfeld, K.**, Wigginton, K., Duhaime, M., Zaman, L. (2024). Parasite-host Coevolution Challenges Phage Therapy Efficacy by Accelerating Antibiotic Resistance Emergence in Avida Experiments, *PNAS*, in prep. *Impact Factor: 12.78*

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## **AWARDS AND HONORS**

1. Towner Prize for Outstanding Ph.D. Research, Honorable Mention 2021
2. CEE Rising Stars Workshop Participant 2020

3. Mead Paper Contest Winner, ASCE Regional Student Conference 2015
  4. Stanley Undergraduate Award for International Research 2014
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## GRANTS AND FELLOWSHIPS

1. Integrated Training in Microbial Systems Mini-Grant 2021
  2. Integrated Training in Microbial Systems Fellowship 2019
  3. National Science Foundation Graduate Research Fellowship 2016
  4. National Defense Science and Engineering Graduate Fellowship 2016
  5. University of Michigan Jack A. Borchart Fellowship 2016
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## PROFESSIONAL CERTIFICATIONS

- FE Exam Passed in Environmental Engineering, Iowa 2016
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## INVITED TALKS

1. *Developing a Quantitative Metagenomic Approach to Explore Viral Community Dynamics Through Wastewater Treatment.* (2021). Department of Biology, Eastern Michigan University, Ypsilanti, MI.
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## CONFERENCE ACTIVITY

### Oral Presentations

1. **Langenfeld, K.**, Hegarty, B., Vidaurri, S., Crossette, E., Duhaime, M., Wigginton, K., June 2022, “Implementing a Rigorous Quantitative Metagenomic Method to Evaluate Viral Community Dynamics through Wastewater”, Environmental Science: Water Gordon Research Seminar, Holderness, NH.
2. **Langenfeld, K.**, Hegarty, B., Vidaurri, S., Crossette, E., Duhaime, M., Wigginton, K., June 2022, “A Rigorous Quantitative DNA Virus Metagenomic Method and Its Limitations”, International Society for Food and Environmental Virology Conference, Santiago de Compostela, Spain.
3. *Abstract accepted, but not presented due to COVID-19.* **Langenfeld, K.**, Wigginton, K., Duhaime, M., Zaman, L., June 2020, “Influence of phage-host coevolution on the evolution of resistance in digital organisms”, American Society for Microbiology Microbe Conference, Chicago, IL.
4. **Langenfeld, K.**, Crossette, E., Duhaime, M., Wigginton, K., September 2019, “Quantitative Viral Metagenomic Method Combining Long and Short Read Sequencing”, International Water Association Health-Related Water Microbiology Conference, Vienna, Austria.

5. **Langenfeld, K.**, Cable, R., Duhaime, M., Wigginton, K., March 2018, “Comparison of Virus Concentration Methods from Various Water Matrices for Detecting the Viral Resistome”, 255<sup>th</sup> American Chemical Society National Meeting and Exposition, New Orleans, LA.

### **Poster Presentations**

1. **Langenfeld, K.**, Hegarty, B., Vidaurri, S., Crossette, E., Duhaime, M., Wigginton, K., June 2022, “Implementing a Rigorous Quantitative Metagenomic Method to Evaluate Viral Community Dynamics through Wastewater”, Environmental Science: Water Gordon Research Seminar, Holderness, NH.
2. **Langenfeld, K.**, Hegarty, B., Wigginton, K., Duhaime, M., June 2020, “Quantitative Viromics Reveals Dynamics of Viral Populations Through Wastewater Treatment”, World Microbe Forum Conference, Virtual Format.
3. *Abstract accepted, but not presented due to COVID-19.* **Langenfeld, K.**, Crossette, E., Wigginton, K., Duhaime, M., June 2020, “Limits of detection and quantification for quantitative viral metagenomics”, American Society for Microbiology Microbe Conference, Chicago, IL.
4. Vidaurri, S., **Langenfeld, K.**, Wigginton, K., Duhaime, M., February 2020, “Long read sequencing of wastewater uncovers complete viral genomes”, 25<sup>th</sup> Triennial Borchardt Conference, University of Michigan, MI.
5. **Langenfeld, K.**, Duhaime, M., Wigginton, K., July 2018, “A Quantitative Method for Exploring the Virome in Wastewater”, Microbiology of the Built Environment Gordon Research Conference, University of New England, ME.
6. **Langenfeld, K.**, Gumm, J., Duhaime, M., Wigginton, K., March 2018, “Quantitative Metagenomics to Determine the Role of Transduction in ARG Dissemination at Wastewater Treatment Plants”, 13<sup>th</sup> Annual Joint Genome Institute User Meeting, San Francisco, CA.
7. **Langenfeld, K.**, Li, A., Zhang, T., Duhaime, M., Wigginton, K., August 2017, “Quantitative Analysis of dsDNA Phage Through Wastewater Treatment Plants”, Environmental Dissemination of Antibiotic Resistance Conference, Lansing, MI.
8. **Langenfeld, K.**, Duhaime, M., Wigginton, K., June 2017, “Viral Extraction Method for Wastewater Sewage, Influent, and Effluent”, Association of Environmental Engineering and Science Professors Conference, Ann Arbor, MI.
9. **Langenfeld, K.**, Just, C.L., April 2016, “Transformation of 2,4-Dinitroanisole by an Endophyte Isolated from Salix “Iowa Willow””, University of Iowa College of Engineering Research Open House, Iowa City, IA.
10. **Langenfeld, K.**, Just, C., November 2015, “Stable isotope-enabled pathway elucidation of 2,4-dinitroanisole metabolized by *Rhizobium litchii*”, University of Iowa Fall Undergraduate Research Festival, Iowa City, IA.
11. Schroer, H., Langenfeld, K., Just, C., October 2015, “Stable isotope-enabled pathway elucidation of 2,4-dinitroanisole metabolized by *Rhizobium litchii*”, 24<sup>th</sup> Annual Center for Biocatalysis and Bioprocessing Conference, Iowa City, IA.

12. **Langenfeld, K.**, Just, C., June 2015, “Numerical analysis of mussel influence on nutrient dynamics”, Association of Environmental Engineering and Science Professors Conference, New Haven, CT.
13. **Langenfeld, K.**, Just, C., April 2015, “Numerical analysis of mussel influence on nutrient dynamics”, University of Iowa College of Engineering Research Open House, Iowa City, IA.
14. McDermot, D., **Langenfeld, K.**, Niemeier, J., Bradley, A., Kruger, A., December 2014, “Inexpensive, robust water stage sensor for rural community footbridges”, American Geophysical Union Conference, San Francisco, CA.

## TEACHING EXPERIENCE

### Teaching Assistant

**Environmental Health Microbiology** Fall 2022

*Dr. Lauren Kennedy, Stanford University*

- Prepared and delivered lectures and labs on human-related viruses (coliphage) in water and human pathogens (*Salmonella*) in water

**Environmental Engineering Principles** Fall 2020

*Dr. Rebecca Lahr, University of Michigan*

- Designed content and facilitated weekly discussion sections
- Wrote problem sets and quiz problems
- Prepared and delivered a lecture on redox reactions and oxygen demand
- Incorporated environmental justice topics into the course content

### Advising

*Doctoral Candidates*

- Peter Arts, *University of Michigan* 2024-Present
- Jessica Bullington, *Stanford University* 2022-2024

*Master's Students*

- Jacob Phaneuf, *Stanford University* 2022-2023
- Ernesto Martinez, *University of Michigan* 2017-2018

*Undergraduates*

- Kieran Javier Barrett, *Stanford University* 2022
- Maria Ridgeway-Elsner, *Stanford University* 2022
- Kaitlyn Chin, *University of Michigan* 2019-2020
- Santiago Vidaurri, *University of Michigan* 2019-2020
- Michael Mata, *University of Michigan* 2019-2019
- Ariel Roy, *University of Michigan* 2018-2019

University of Iowa Team Ambassador, Bridges to Prosperity 2016-2017

## SERVICE TO PROFESSION

### **Journal Reviewer Activities**

Environmental Science & Technology	10 Reviews
Environmental Science: Water Research & Technology	7 Reviews
Microbiome	2 Reviews
Environmental Science: Advances	1 Review
Computational and Structural Biotechnology Journal	1 Review
Reviews in Environmental Science and Bio/Technology	1 Review
Journal of Visualized Experiments	1 Review

### **Conference Organization**

AEESP Conference Student Organizing Committee Member, Ann Arbor, MI	2017
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## **DEPARTMENTAL AND UNIVERSITY SERVICE**

### **University Committees and Panels**

CEE Diversity, Equity, and Inclusion Committee, <i>University of Michigan</i>	2020-2021
<ul style="list-style-type: none"><li>Member of Learning Community subcommittee focused on improving inclusivity in courses and incorporating social and environmental justice topics into the curriculum</li></ul>	
ITiMS Mini-Grants Reviewer, <i>University of Michigan</i>	2019
<ul style="list-style-type: none"><li>Questioned and critiqued NSF-style proposals for \$10,000 grants during mock site visits</li></ul>	

### **Extracurricular Service**

University Relations Committee Chair, <i>Engineers in Action Bridge Program</i>	2016-2021
<ul style="list-style-type: none"><li>Engineers in Action (EIA) Bridge Program provides international service learning experiences to undergraduates at several institution in the U.S. and Canada by teaching fundamental design, construction, and cross-cultural communication skills through pedestrian bridge projects in Bolivia and Eswatini</li><li>Assessed learning outcomes for each chapter in the program and developed methods to improve students' learning and project performance</li></ul>	

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## **COMMUNITY INVOLVEMENT AND OUTREACH**

Analyzing Fecal Indicator Bacteria in Local Water with Girls' Middle School	2023
<ul style="list-style-type: none"><li>Taught metrics for examining environmental water quality and local case studies of sewer overflows</li><li>Prepared hands-on research experience for middle school girls that included sample collection and testing concentrations of fecal indicator bacteria</li></ul>	
Examining Beach Aquifer Water Quality with Frick United Academy of Language	2022
<ul style="list-style-type: none"><li>Organized field trips for middle school students from East Oakland, CA to learn about the scientific process, coastal water quality, and future STEM careers</li><li>Designed hands-on experiences where students collected samples from the Stinson Beach Aquifer</li></ul>	
Skype a Scientist Presenter – <i>Power of Microbes</i>	2020

Ask a Scientist Presenter – <i>N95 Mask Disinfection Strategies</i>	2020
Science Communicators Fellow, <i>UM Museum of Natural History</i>	2020
Science Café Presenter with the Duhaime Research Group, <i>University of Michigan</i>	2019
CEE Session Leader for Discover Engineering, <i>University of Michigan</i>	2018

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## **PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS**

American Society for Microbiology  
 American Chemical Society  
 International Water Association  
 Association of Environmental Engineering & Science Professors  
 International Society for Food and Environmental Virology