Claire Duvallet

I am a PhD in computational biology using data science to impact society.

Education

Massachusetts Institute of Technology, *Cambridge, MA* 2014 – 2019
Ph.D., Biological Engineering, January 2019

Columbia University, *New York, NY* 2009 – 2013
B.S., Biomedical Engineering

Experience

Biobot Analytics 2019 – present
Data Scientist

Biobot Analytics measures opioids in sewage to estimate consumption in cities. As Biobot's first data scientist, I lead our data analytics and visualization efforts, communicate the value of our novel public health data, and serve as the main point of contact for our customers, public health and city officials.

Research

Massachusetts Institute of Technology 2015 – 2019
Supervisor: Eric J. Alm, Ph.D.
Ph.D., *Department of Biological Engineering* (2015 – Jan. 2019)
Postdoc (Feb. 2019 – Apr. 2019)

I studied the relationship between the microbiome and health and disease, mining large clinical and biological datasets to extract scientific insight.

Columbia University 2011 – 2013
Supervisor: Samuel L. Sia, Ph.D.
Molecular and Microscale Bioengineering Laboratory

As an undergraduate researcher, I worked on developing a point-of-care microfluidic device to diagnose multi-drug resistant tuberculosis in resource-limited settings.

Ecole Polytechnique Summer 2012
Supervisor: Cedric Norais, Ph.D.
Laboratoire de Biochimie

As an international undergraduate research intern, I studied the acquired-immunity CRISPR system in *E. coli*.

Teaching Experience

Teaching Assistant Fall 2015
20.106 Systems Microbiology, *Massachusetts Institute of Technology*

I was a TA for seven advanced undergraduate students in a new course on the human microbiome, emerging disease, phylogenetics, and host-microbe interactions.

Lecturer 2013 – 2014
Biomedical Equipment Technology Department, *University of Puthisastra*
Engineering World Health, *Phnom Penh, Cambodia*

As a Luce Scholar, I was one of the first lecturers for Engineering World Health's new Associate Bachelors program in Biomedical Equipment Technology at the University of Puthisastra, a private university in Phnom Penh.

Teaching Assistant 2012 – 2013
The Art of Engineering, *Columbia University*

My senior year at Columbia, I TAed the biomedical engineering section of the introductory engineering course for freshmen.

Publications

1. **Claire Duvallet**, Bryan D Hayes, Timothy B Erickson, Peter R Chai, Mariana Matus. *in press*
"Mapping community opioid exposure through wastewater-based epidemiology as a means to engage pharmacies in harm reduction efforts."
Preventing Chronic Disease.

2. Fuqing Wu, Amy Xiao, Jianbo Zhang, Xiaoqiong Gu, Wei Lin Lee, Kathryn Kauffman, William Hanage, Mariana Matus, Newsha Ghaeli, Noriko Endo, **Claire Duvallet**, Katya Moniz, Timothy Erickson, Peter Chai, Janelle Thompson, Eric Alm. (2020)
"SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases."
medRxiv, doi: 10.1101/2020.04.05.20051540.

3. Noriko Endo, Newsha Ghaeli, **Claire Duvallet**, Katelyn Foppe, Tim Erickson, Mariana Matus, and Peter Chai. (2020)
"Rapid assessment of opioid exposure and treatment in cities through robotic collection and chemical analysis of wastewater."
Journal of Medical Toxicology, doi: 10.1007/s13181-019-00756-5.

4. **Claire Duvallet**. (2020)
"Data detectives, self-love, and humility: a research parasite's perspective."
GigaScience, doi: 10.1093/gigascience/giz148.

5. Mariana Matus, **Claire Duvallet**, Newsha Ghaeli, Melissa Kido Soule, Krista Longnecker, Ilana Brito, Carlo Ratti, Elizabeth B. Kujawinski, and Eric Alm. (2019)
"24-hour multi-omics analysis of residential sewage reflects human activity and informs public health."
bioRxiv, doi: 10.1101/728022.

6. **Claire Duvallet**, Kara Larson, Scott Snapper, Sonia Iosim, Ann Lee, Katherine Freer, Kara May, Eric Alm, and Rachel Rosen. (2019)
"Framework for rational donor selection in fecal microbiota transplant clinical trials."
PLoS ONE, doi: 10.1371/journal.pone.0222881.

7. Evan Bolyen, Jai Ram Rideout, Matthew R. Dillon, Nicholas A. Bokulich ... **Claire Duvallet** ... Rob Knight, Greg Caporaso. (2019)
"Reproducible, interactive, scalable and extensible microbiome data science using QIIME 2."
Nature Biotechnology, doi: 10.1038/s41587-019-0209-9.

8. Chengzhen Dai, **Claire Duvallet**, An Ni Zhang, Mariana Matus, Newsha Ghaeli, Shinkyu Park, Noriko Endo, Siavash Isazadeh, Tong Zhang, Kazi Jamil, Carlo Ratti, and Eric Alm. (2019)
"Multi-site sampling and risk prioritization reveals the public health relevance of antibiotic resistance genes found in sewage environments."
bioRxiv, doi: 10.1101/562496v1.

9. **Claire Duvallet**, Caroline Zellmer, Pratik Panchal, Shrish Budree, Madji Osman, and Eric Alm. (2019)
"Aerodigestive sampling reveals altered microbial exchange between lung, oropharyngeal,

and gastric microbiomes in children with impaired swallow function."
PLoS ONE, doi: 10.1371/journal.pone.0216453.

10. Keegan Korthauer*, Patrick Kimes*, **Claire Duvallet**†, Alejandro Reyes†, Ayshwarya Subramanian†, Mingxiang Teng, Chinmay Shukla, Eric Alm, and Stephanie Hicks. (2019)
"A practical guide to methods controlling false discoveries in computational biology."
Genome Biology, doi: 10.1186/s13059-019-1716-1.

11. Thomas Gurry, HST Microbiome Consortium, Sean M Gibbons, Sean M Kearney, Ashwin Ananthakrishnan, Xiaofang Jiang, **Claire Duvallet**, Zain Kassam, and Eric J Alm. (2018)
"Predictability and persistence of prebiotic dietary supplementation in a healthy human cohort."
Scientific Reports. doi: 10.1038/s41598-018-30783-1.

12. Sean Gibbons, **Claire Duvallet**, and Eric Alm. (2018)
"Correcting for batch effects in case-control microbiome studies."
PLoS Computational Biology. doi: 10.1371/journal.pone.0176335.

13. **Claire Duvallet**. (2018)
"Meta-analysis generates and prioritizes hypotheses for translational microbiome research."
Microbial Biotechnology. doi: 10.1111/1751-7915.13047.

14. **Claire Duvallet**, Sean Gibbons, Thomas Gurry, Rafael Irizarry, and Eric Alm. (2017)
"Meta-analysis of gut microbiome studies identifies disease-specific and shared responses."
Nature Communications. doi: 10.1038/s41467-017-01973-8.

    - Received PSB Award for Rigorous Secondary Data Analysis

15. Scott Olesen, **Claire Duvallet**, and Eric Alm. (2017)
"dbOTU3: A new implementation of distribution-based OTU calling."
PloS ONE. doi: 10.1371/journal.pone.0176335.

Oral presentations

1. "24-hour multi-omics analysis of residential sewage reflects human activity and informs public health." American Chemical Society National Meeting. Wastewater-Based Epidemiology: Opportunities, Challenges & Applications to Public Health & Safety. San Diego, CA. Aug. 2019. *Invited*.

2. "Intro to microbiome data visualization." Cornell University 2019 Microbiome Hackathon: Microbiome Hack. Ithaca, NY. Apr. 2019. *Invited*.

3. "Framework for rational donor selection in fecal microbiota transplant clinical trials." International Conference on Microbiome Engineering (ICME 2018). Boston, MA. Nov. 2018. *Invited*.

4. "Predictive power of the microbiome." Science on Tap! Boston College Department of Biology seminar series. Boston, MA. Aug. 2018. *Invited*.

5. "Distribution-based methods to increase power and reduce redundancy in microbiome data." Teaching and Developing QIIME 2 Workshop. San Diego, CA. May 2018. *Selected*.

6. "Meta-analysis to identify consistent disease-associated microbiome shifts." MIT-Harvard Microbiome Symposium. Cambridge, MA. March 2018. *Selected*.

Software

Percentile normalization
Correcting batch effects in case-control microbiome studies.
Python implementation (*contributor*) and QIIME 2 plugin (*developer*).

Distribution-based OTU calling
New implementation of Preheim *et al.*'s distribution-based OTU clustering algorithm.
Python implementation (*contributor*) and QIIME 2 plugin (*developer*).

Amplicon sequencing pipeline
End-to-end pipeline to process 16S data.
Python implementation (*co-developer*).

Skills & Expertise

Expertise: Human microbiome (statistical analysis; gut & lung microbiome; FMT clinical trial design; bioinformatics tools), meta-analysis, wastewater epidemiology, public health data science.

Technical: Python (pandas, seaborn, matplotlib, scikit-learn, etc); geospatial (QGIS, geopandas, folium); git and GitHub; AWS (S3, EC2, Glacier, IAM); bash; LaTeX; R (proficient); data wrangling and exploration; machine learning; NGS analysis (16S, metagenomics); untargeted metabolomics analysis.

Non-technical: conflict management; student advocacy; project management; oral and written communication; diversity, equity, and inclusion.

Languages: English (native), French (fluent), Spanish (conversational), Khmer (beginner)

Fellowships & Awards

Fellowships

Siebel Scholars Foundation — 2018
Siebel Scholar Class of 2019

National Defense Science and Engineering Graduate Fellowship — 2015 – 2018
NDSEG Recipient

National Science Foundation Graduate Research Fellowship — 2015
Honorable Mention

Henry Luce Foundation — 2013 – 2014
Luce Scholar, Engineering World Health Cambodia

Awards

PSB Award for Rigorous Secondary Data Analysis — 2019
Junior Research Parasite

MIT Graduate Women of Excellence — 2017

Salutatorian — 2013
Columbia University Fu Foundation School of Engineering and Applied Science

Richard Skalak Award in Biomedical Engineering — 2013
Columbia University Department of Biomedical Engineering

Robert E. and Claire S. Reiss Prize in Biomedical Engineering — 2013
Columbia University Department of Biomedical Engineering

King's Crown Bronze Leadership Award — 2012
Columbia University

Tau Beta Pi, The Engineering Honor Society — 2012

Leadership & Service

Academic and professional

Bluebonnet Data — 2019 – present
Volunteer data analytics for state and local campaigns
Team lead and data scientist

MIT Microbiome Club — 2015 – 2018
Co-founder, president, and executive board member

MIT-Harvard Microbiome Symposium — 2016 and 2017
Co-founder and organizing committee

MIT Biotech Group — 2017 – 2018
Beyond the Bench Initiative board member

Departmental and MIT

Biological Engineering Department Visiting Committee — 2018
Graduate student representative

Graduate Student Advisory Group for Engineering (GradSAGE) — 2017 – 2018
Advisory group to the Dean of the School of Engineering
Advisor/Advisee Relations Subcommittee

MIT Graduate Student Council — 2017 – 2019
Diversity and Inclusion Subcommittee
Vice Chair, Department and Classroom Inclusion co-coordinator

BE Resources for Easing Friction and Stress (BE REFS) — 2016 – 2019
Confidential conflict management coach and graduate student advocate

BE Graduate Student Board — 2015 – 2018
Diversity Chair

Co-founder, BE Application Assistance Program
Lead author, BE Departmental Values Statement
Co-lead, 2016 BE Diversity Survey

Reviewer

Academic peer reviewer

Nature Microbiology	2020
mSystems	2019
GigaScience	2019
Scientific Data	2019
Food Research International	2018

MIT Summer Research Program (MSRP) Reviewer — 2018 and 2019

MIT Committed to Caring Selection Committee — 2017

MIT IDEAS Global Challenge Reviewer — 2015 – 2018

Outreach & Mentorship

MIT Microbiome superUROP — 2016 – 2017
Mentor, supervised one undergraduate researcher

Science Club for Girls, Young Leaders in STEM — 2016 and 2017
Volunteer, developed and taught three-day course on microbiology and the human microbiome

MIT SPLASH — 2015
Volunteer, "Microbiome 101: What's in your poop?"

E3: Empowering, Encouraging, and Eliminating Barriers for Women in STEM — 2015
Mentor (2015), guest presenter (2016)

ESL Program for MIT Service Employees — 2015 – 2018
Math GED tutor