Claire Duvallet

CONTACT

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Allston, MA 02134

EDUCATION

Massachusetts Institute of Technology, *Cambridge, MA* 2014 – 2019

Ph.D., Biological Engineering
GPA: 5.0/5.0

Columbia University, *New York, NY* 2009 – 2013

B.S., Biomedical Engineering, *cell and tissue engineering track*
GPA: 4.1/4.0, *Summa cum laude*

RESEARCH

Massachusetts Institute of Technology 2015 – present
Department of Biological Engineering
Supervisor: Eric J. Alm, Ph.D.

I study the relationship between the microbiome and health and disease, and am generally interested in personalized medicine approaches for public health applications.

- Performed a meta-analysis of 28 case-control gut microbiome studies across 10 disease states
- Characterized the lung, gastric, and oropharyngeal microbiomes of pediatric patients with impaired swallow function
- Proposed a framework for donor selection in fecal microbiota transplant clinical trials
- Mining untargeted metabolomics data from residential sewage to identify human-derived biomarkers
- Developing methods to process and analyze untargeted metabolomics of blood for precision diagnostics and outcome prediction

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

As an undergraduate research assistant, I worked on developing a point-of-care microfluidic device to diagnose multi-drug resistant tuberculosis.

- Designed and developed the DNA amplification and detection modules of point-of-care diagnostic
- Optimized primers, detection probes, reagents, and reaction conditions for multiplex, fast, and isothermal PCR reactions

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

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

- Constructed plasmids to study components of the CRISPR system in *E. coli* and expressed and purified CasBCD*E protein complex

Publications

1. **Claire Duvallet**, Caroline Zellmer, Pratik Panchal, Shrish Budree, Madji Osman, and Eric Alm. (2018)
"Framework for rational donor selection in fecal microbiota transplant clinical trials."
in preparation.

2. Mariana Matus, **Claire Duvallet**, Newsha Ghaeli, Melissa Soule, Krista Longnecker, Ilana Brito, Carlo Ratti, Elizabeth B. Kujawinski, Eric Alm. (2018)
"Untargeted detection of human health and activity markers in residential wastewater through microbiome sequencing and metabolomics."
in preparation.

3. **Claire Duvallet**, Kara Larson, Scott Snapper, Sonia Iosim, Ann Lee, Katherine Freer, Kara May, Eric J. Alm, and Rachel Rosen. (2018)
"Aerodigestive sampling reveals altered microbial exchange between lung, oropharyngeal, and gastric microbiomes in children with impaired swallow function."
PLoS ONE, submitted.

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

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

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

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

8. *[Non-peer reviewed blog post]* **Claire Duvallet**. (2017)
"Beyond dysbiosis: disease-specific and shared microbiome responses to disease."
Nature Microbiology Community Forum.

9. *[Dataset]* **Claire Duvallet**, Sean M. Gibbons, Thomas Gurry, Rafael A. Irizarry, and Eric J. Alm. (2017)
"MicrobiomeHD: the human gut microbiome in health and disease."
Zenodo. doi: 10.5281/zenodo.797943

Presentations

Oral presentations

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

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

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

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

5. "Meta-analysis to identify consistent disease-associated microbiome shifts." MIT Department of Biological Engineering Retreat. Cambridge, MA. October 2017. *Invited.*

Poster presentations

1. "Meta-analysis of gut microbiome studies identifies disease-specific and shared responses." *Women in Data Science Cambridge*, March 2018 and *Pacific Symposium on Biocomputing*, January 2018

2. "Empirical signatures of compositional stability in the gut microbiome." *Statistical and Algorithmic Challenges in Microbiome Data Analysis Workshop*, MIT Center for Informatics and Therapeutics and The Simons Center for Data Analysis, February 2016.

Software

Percentile normalization
Correcting batch effects in case-control microbiome studies. (Gibbons *et al.*, 2018).

Python implementation: github.com/seangibbons/percentile_normalization *(contributor)*
QIIME 2 plugin: github.com/cduvallet/q2-perc-norm *(developer)*

Distribution-based OTU calling
New implementation of Preheim *et al.*'s distribution-based OTU clustering algorithm. (Preheim *et al.*, 2013; Olesen *et al.*, 2017).

Python implementation: github.com/swo/dbotu3 *(contributor)*
QIIME 2 plugin: github.com/cduvallet/q2-dbotu *(developer)*

Amplicon sequencing pipeline
End-to-end pipeline to process 16S data.

Python: github.com/thomasgurry/amplicon_sequencing_pipeline *(co-developer)*

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

Awards

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

Valedictorian 2009
James Bowie High School, ranked first out of 636 students

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.

- Developed problem sets and guided lecture content for a module on processing and analyzing 16S data
- Facilitated and participated in paper discussions on various topics in zoonotic disease, viral communities, host immune responses, and the human microbiome
- Mentored students on project re-processing and re-analyzing published microbiome datasets with machine learning tools

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.

- Developed curricula and syllabi for anatomy and physiology, troubleshooting skills, and math modules
- Prepared and delivered lectures, exams, assignments, in-class activities, and demos for two classes of 12-18 Cambodian students and technicians (in English, with a translator)
- Managed Cambodian student-teaching staff during main supervisor's absence and supported foreign and local teaching staff

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.

- Assisted students in designing and building a vital-signs monitoring device, guiding them through the engineering design process
- Taught concepts in MATLAB and circuitry required for projects

Leadership & Service

Academic and professional

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

MIT Microbiome Club — 2015 – 2018
Co-Founder, President, Executive board member

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

Departmental and MIT

Biological Engineering Department Visiting Committee — 2018
Graduate student representative

Graduate Student Advisory Group for Engineering (GradSAGE) — 2017 – present
Advisory group to the Dean of the School of Engineering
Advisor/Advisee Relations Sub-Committee

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

BE Resources for Easing Friction and Stress (BE REFS) — 2016 – present
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

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

Reviewer

MIT Summer Research Program (MSRP) Reviewer — 2018

MIT Committed to Caring Selection Committee — 2017

MIT IDEAS Global Challenge Reviewer — 2015 – present