

ALLISON J. LOPATKIN, PH.D.

Curriculum Vitae

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New York, NY 10027

ACADEMIC APPOINTMENTS

Fall 2019 – Present	Barnard College <i>Assistant Professor</i> Computational Biology, Dept. of Biology
Fall 2020 – Present	Columbia University, Data Science Institute <i>Affiliated faculty</i>
Fall 2020 – Present	Columbia University, Ecology evolution & environmental Biology <i>Affiliated faculty</i>
Fall 2017 – Fall 2019	Massachusetts Institute of Technology <i>Postdoctoral Fellow</i> Dept. of Biological Engineering Broad Institute of MIT and Harvard Infectious Disease and Microbiome Program Harvard University Wyss Institute for Biologically Inspired Devices
Fall 2013 – 2017	Duke University <i>Doctoral Candidate</i> Dept. of Biomedical Engineering Dissertation: “Quantifying and inhibiting horizontal gene transfer-mediated antibiotic resistance.”
Spring 2012 – Summer 2013	URMC Department of Biomedical Engineering <i>Research Assistant</i> Advisor: Eddie Schwarz, Ph.D.

EDUCATION AND TRAINING

Fall 2017 – Fall 2019	Massachusetts Institute of Technology Postdoctoral Fellow, Dept. of Biological Engineering Advisor: Jim Collins, Ph.D.
Fall 2013 – 2017	Duke University Ph.D., Biomedical Engineering Thesis advisor: Lingchong You, Ph.D.
Fall 2009 – 2013	University of Rochester B.S., Applied Mathematics <i>Cum laude</i> with High Distinction

SELECTED PUBLICATIONS

Name indicates student involvement
* indicates equal contribution

1. H. Prenskey, A. Gomez-Simmonds, A. C. Uhlemann, and **A. J. Lopatkin**. "Conjugation dynamics depend on both the plasmid acquisition cost and the fitness cost" *Molecular Systems Biology* (2021). doi: 10.1525/msb.20209913
2. **A. J. Lopatkin**, S. C. Bening, A. L. Manson, J. M. Stokes, M. A. Kohanski, A. H. Badram, A. M. Earl, N. J. Cheney, J. H. Yang, and J. J. Collins. "Clinically relevant mutations in core metabolic genes confer antibiotic resistance," *Science* (2021). doi: 10.1126/science.aba0862
3. **A. J. Lopatkin** and Jason H. Yang. "Nucleotide metabolism and antibiotic treatment failure," *Frontiers in Microbiology* (2021). doi: 10.3389/fdgth.2021.583468
4. **A. J. Lopatkin** and J. J. Collins. "Predictive biology: modeling, understanding, and harnessing microbial complexity," *Nature Microbiology Reviews* (2020). doi: 10.1038/s41579-020-0372-5
5. J. Bethke, A. Davidovich, L. Cheng, **A.J. Lopatkin**, J. T. Thaden, V. G. Fowler Jr., M. Xiao, and L. You. "Environmental and genetic determinants of plasmid mobility in pathogenic *Escherichia Coli*," *Science Advances* (2020). doi: 10.1126/sciadv.aax3173
6. T. Sysoeva, Y. L. Kim, J. Rodriguez, **A. J. Lopatkin**, and L. You. "Growth-stage dependent regulation of conjugation," *AIChE Journal* (2019). doi: 10.1002/aic.16848.
7. **A. J. Lopatkin**, J. Stokes, E. Zheng, J. H. Yang, M. Takahashi, L. You, and J. Collins. "Bacterial metabolic state more accurately predicts antibiotic lethality than growth rate," *Nature Microbiology* (2019). doi: 10.1038/s41564-019-0536-0
8. J. M. Stokes, **A. J. Lopatkin**, M. A. Lobritz, J. J. Collins. "Bacterial Metabolism and Antibiotic Efficacy," *Cell Metabolism* (2019). doi: <https://doi.org/10.1016/j.cmet.2019.06.009>
9. J. H. Yang, S. N. Wright*, M. Hamblin*, D. McCloskey, M. A. Alcantar, L. Schrubbers, **A. J. Lopatkin**, S. Satish, A. Nili, J. J. Collins. "A white-box machine learning approach for revealing antibiotic mechanisms of action," *Cell* (2019). doi: <https://doi.org/10.1016/j.cell.2019.04.016>
10. J. Stokes*, A. Gutierrez*, **A. J. Lopatkin**, I. Andersson, and J. Collins. "A high-throughput killing assay for screening antibiotic lethality," *Nature Methods* (2019). 10.1038/s41592-019-0333-y
11. F. Wu, **A. J. Lopatkin**, D. Needs, C. Lee, S. Mukherjee, and L. You. "A unifying framework for interpreting and predicting mutualistic systems," *Nature Communications* (2019). doi: 10.1038/s41467-018-08188-5
12. H. R. Meredith, V. Andreani, A. J. Lee, **A. J. Lopatkin**, G. Batt, and L. You. "Differentiating resilience and resistance informs how to manipulate bacterial antibiotic response." *Science Advances* (2018). doi: 10.1126/sciadv.aau1873.
13. J. K. Srimani, S. Huang, **A. J. Lopatkin**, and L. You. "Drug detoxification dynamics explain the postantibiotic effect." *Molecular System Biology*, vol. 13, p. 948 (2017). doi: 10.15252/msb.20177723.
14. **A. J. Lopatkin**, H. R. Meredith, J. K. Srimani, C. Pfeiffer, R. Durrett, and L. You, "Promotion and reversal of plasmid-mediated antibiotic resistance." *Nature Communications*, vol. 8, p. 1689 (2017). doi: 10.1038/s41467-017-01532-1.
15. C. E. Wilson, **A. J. Lopatkin**, T. J. A. Craddock, W. Driscoll, Omar T. Eldakar, Jose V. Lopez and R. P. Smith. "Cooperation and competition shape ecological resistance during periodic spatial disturbance of engineered bacteria." *Scientific Reports*, vol. 7, p. 440 (2017). doi:10.1038/s41598-017-00588-9.
16. Y. Cao*, **A. J. Lopatkin*** and L. You. "Elements of biological oscillations in time and space," *Nature Structural & Molecular Biology*, vol. 23, p. 1030-1034 (2016). doi:10.1038/nsmb.3320.
17. **A. J. Lopatkin**, T. A. Sysoeva, and L. You, "Dissecting the effects of antibiotics on horizontal gene transfer: Analysis suggests a critical role of selection dynamics," *Bioessays*, vol. 38, p. 1283-1292 (2016). doi: 10.1002/bies.201600133.

18. **A. J. Lopatkin**, S. Huang, R. P. Smith, J. K. Srimani, T. A. Sysoeva, S. Bewick, D. K. Karig, and L. You, “Antibiotics as a selective driver for conjugation dynamics,” *Nature Microbiology*, p. 16044 (2016). doi: 10.1038/nmicrobiol.2016.44.
19. S. Huang, J. K. Srimani, A. J. Lee, Y. Zhang, **A. J. Lopatkin**, K. W. Leong, and L. You, “Dynamic control and quantification of bacterial population dynamics in droplets,” *Biomaterials*, vol. 61, pp. 239–45 (2015). doi: 10.1016/j.biomaterials.2015.05.038.
20. T. J. Lee, J. Wong, S. Bae, A. J. Lee, **A. Lopatkin**, F. Yuan, and L. You, “A power-law dependence of bacterial invasion on Mammalian host receptors,” *PLoS Comput. Biol.*, vol. 11, no. 4, p. e1004203 (2015). doi: 10.1016/j.micinf.2008.07.004.
21. H. R. Meredith, **A. J. Lopatkin**, D. J. Anderson, and L. You, “Bacterial Temporal Dynamics Enable Optimal Design of Antibiotic Treatment,” *PLoS Comput Biol*, vol. 11, no. 4, p. e1004201 (2015). doi: 10.1371/journal.pcbi.1004201.
22. H. R. Meredith, J. K. Srimani, A. J. Lee, **A. J. Lopatkin**, and L. You, “Collective antibiotic tolerance: mechanisms, dynamics and intervention,” *Nat Chem Biol*, vol. 11, no. 3, pp. 182–188 (2015). doi: 10.1038/nchembio.1754.
23. **A. J. Lopatkin** and L. You, “Synthetic biology looks good on paper,” *Cell*, vol. 159, no. 4, pp. 718–720 (2014). doi: <http://dx.doi.org/10.1016/j.cell.2014.10.003>.

PUBLICATIONS IN PRESS

24. S. C. Williams, A. P. Forsberg, J. Lee, C. Vizcarra, **A. J. Lopatkin**, and R. N. Austin “Investigation of the prevalence and catalytic activity of fused-rubredoxin alkane monooxygenases (AlkB_s)” (*In press*, Journal of Inorganic Biochemistry)

PUBLICATIONS IN REVIEW

25. D. M. Bach, M. A. Holzman, F. Wague, **A. J. Lopatkin**, J. H. Mansfield, and J. W. Snow. “Thermal stress induces tissue damage and broad shift in regenerative signaling pathways in the honey bee intestine” (*Under revisions*, Journal of Experimental Biology)
26. **A. J. Lopatkin** and Robert P. Smith. “Temporal decoupling of growth and metabolism under antibiotic treatment” (*Under Review*, PLOS Computational Biology)

PUBLICATIONS IN PREPARATION

27. A. Palomino, J. Moralez, U. Zajmi, H. Prensky, and **A. J. Lopatkin**. “The mobile metabolome of *Escherichia coli* plasmids”
28. M. E. Shoen, M. A. Jahne, J. Garland, L. Ramirez, **A. J. Lopatkin**, and K. Hamilton. “Quantitative microbial risk assessment of antibacterial resistant and susceptible *Staphylococcus aureus* in reclaimed wastewaters”
29. **A. J. Lopatkin**, J. Kreitz, F. A. Tosto, W. S. Choi, H. R. Meredith, and L. You. “A novel β -lactam mechanism induces collective cell death”
30. S. C. Bening, I. W. Andrews, M. Hamblin, **A. J. Lopatkin**, and J. J. Collins. “Sensitizing tolerant bacteria to β -lactam antibiotics”

SELECTED CONFERENCES & PRESENTATIONS

March 2021	ASU, Environmental Engineering Seminar (virtual) Invited seminar “Predictive biology: understanding and reversing the evolution of antibiotic resistance”
March 2021	Cornell, Antimicrobial Resistance Center Seminar (virtual) Invited seminar “Predictive biology: understanding and reversing the evolution of antibiotic resistance”
February 2021	Yale, Department of Ecology and Evolution Seminar(virtual) Invited seminar “Predictive biology: understanding and reversing the evolution of antibiotic resistance”
January 2021	Phytobiomes Alliance (virtual) Invited webinar “Predictive biology: understanding and reversing the evolution of antibiotic resistance”
Fall 2020	FEMS Conference on Microbiology (virtual) Invited talk “Predicting and inhibiting the spread of plasmid-mediated antibiotic resistance”
Fall 2019	Soil Science Society of America’s Annual Meeting Invited talk “Antibiotic lethality is better correlated with metabolic state than growth rate”
July 2019	MIT Faculty Forum Online Invited webinar “Machine learning insights into Antibiotic Lethality”
Summer 2019	Summer qBio Contributing talk “Antibiotic lethality is better correlated with metabolic state than growth rate”
Winter 2018	Broad Institute Annual Retreat Invited talk “Antibiotic lethality directly depends on bacterial metabolic state”
Winter 2017	Winter qBio Contributing talk “Reversing plasmid-mediated antibiotic resistance”
Winter 2017	Winter qBio Poster “A novel β -lactam mechanism promotes selection for resistant mutants,” by Allison J. Lopatkin , Joseph Kreitz, and Lingchong You
Spring 2016	Academy of Managed Care Pharmacy Poster “Patterns of antibiotic treatment failure in pediatric community-acquired bacterial pneumonia in the USA,” by Allison J. Lopatkin , Peter Classi, Pamela Landsman-Blumberg, Cathy Carroll, Sharanya Murty, Samantha Slaff, and Glenn Tillotson

Spring 2016	Host-pathogen Interaction supergroup Invited talk “Antibiotic influence on horizontal gene transfer”
Winter 2016	Winter qBio Poster “Optimal dosing of beta-lactam antibiotics for ESBL-producing pathogens is guided by recovery growth rates,” by Hannah R. Meredith, Allison J. Lopatkin , and Lingchong You
Summer 2015	Summer qBio Contributing talk “Microbial growth dynamics govern conjugation efficiency in the presence of antibiotics”
Winter 2015	Winter qBio Poster “A novel β -lactam mechanism induces collective cell death,” by Allison J. Lopatkin and Lingchong You
Summer 2014	Cold Spring Harbor Labs Summer Course – Synthetic Biology Accepted to attend two week intensive workshop on the newest techniques in synthetic biology
Spring 2014	Duke University CSB Symposium Poster “A novel β -lactam mechanism induces collective cell death,” by Allison J. Lopatkin and Lingchong You
Fall 2014	GSK RTP Chemical Biology and Biotechnology Symposium Poster “A novel β -lactam mechanism induces collective cell death,” by Allison J. Lopatkin and Lingchong You
Summer 2012	Mount Sinai Systems Biology Summer Symposium Poster “Understanding Parameters of Ventricular Myocyte Models Utilizing Markov Pathways,” by Allison J. Lopatkin and Eric Sobie

COMPETITIVE FUNDING

National Science Foundation RUI, *Barnard College (2021-2024)*

Collaborative Research: RUI: A multi-scale quantification of the plasmid acquisition in *Escherichia coli* pathogens

Award number: 2040697

P.I. Allison Lopatkin

Amount: \$387,732

President’s Faculty Research and Development Grant, *Nova Southeastern University (2020-2023)*

Determining how metabolic efficiency determines the inoculum effect

P. I. Robert P. Smith

Amount: \$20,000

Role: Collaborator

President’s Faculty Research and Development Grant, *Nova Southeastern University (2017-2019)*

Using Periodic Spatial Disturbance to manipulate Cooperation in Bacteria. P.I., Robert Smith

P. I. Robert P. Smith

Amount: \$20,000

Role: Collaborator

PROFESSIONAL EXPERIENCE

Summer 2020 – Present	Pathogens <i>Topics editor</i> Oversees special topics issues; evaluates applicants for awards; participates in discussions of Journal development strategies
Spring 2020 – Present	BIOL BC2500, MATLAB For Scientists Developed new computational course for Biology students with no programming background to learn data analysis in the language MATLAB
September 2018 – Present	Infectious Disease Hub <i>Early Career Panel Ambassador</i> Provides expert advice to direct the content of the site and contributes writing pieces on relevant topics
Fall 2017 – Present	MIT Department of Biological Engineering <i>Graduate student mentor</i> Oversaw/advised graduate student projects; held weekly meetings to ensure students stayed on track
January 2019	Boston University Medical School <i>Systems Pharmacology and Therapeutics II lecturer</i> Section lead for combined lecture and discussion-based format; antibiotics module in pharmacology class
September 2018	LabRoots <i>Invited educational seminar speaker, P.A.C.E. CE</i> Microbiology and Immunology series, “A Mathematical Perspective of Antibiotic Resistance: Understanding and inhibiting horizontal gene transfer”
June – December 2016	Cempra Pharmaceuticals <i>Consultant, Medical Science Liaison</i> Novel research using mathematical modeling to predict resistance trends of novel macrolide antibiotic, Solithromycin
Fall 2015/2016	Duke University <i>Teaching Assistant, Lab Instructor</i> Course: BME 260L, <i>Modeling Cellular and Molecular Systems</i> Created content, lead laboratory sessions, held office hours and review sessions, graded exams, primary point of contact
Fall-Spring 2010/2011/2012	University of Rochester <i>Teaching Assistant</i> Course: MTH 161, 162 <i>Calculus I, II</i> Lead recitation sessions, held office hours and review sessions, proctored exams

HONORS, AWARDS, AND MEMBERSHIPS

Member, American Society of Microbiology **(2019 – present)**

Keewaunee Student Achievement Award, *Duke University* **(2017)**

PhD Plus – Executive committee networking co-chair **(2015 – 2017)**

Women And Math – Mentor to young women in STEM, *Duke University* **(2013 – 2017)**

Sigma Xi Biology Honors Society – Vice President, *Duke University* **(2014 – 2017)**

WISE – Mentor and coordinator, *University of Rochester* and *Duke University* **(2009 – 2017)**

ACS Synthetic biology second place poster prize, *Winter qBio* **(2015)**

NSF GRFP Honorable Mention **(2014, 2015)**

Howard G. Clark Graduate Research Grant, *Duke University* **(2014 – 2015)**

CSB Summer Travel Grant, *Duke University* **(Summer 2015)**

Jonathon Wilder Scholarship, *University of Rochester* **(2009 – 2013)**

Dean's Scholarship for Academic Excellence, *University of Rochester* **(2009-2013)**

REACH Grant, *University of Rochester* **(2012)**

COMMITTEE SERVICE

Phd Advisory Committee, Laura Dudley-Plimpton – Columbia University, E3B

Radiation Safety Committee – Columbia University and Barnard College

JOURNAL REVIEWER

- PNAS
- Science Advances
- PloS Computational Biology
- Environmental Science and Technology
- COMMS Bio
- iScience
- mSphere
- Rolex foundation
- ISME
- Biology
- Plasmid
- Cell reports
- Pathogens
- Antibiotics
- Dutch Research Council
- International Review of Cell and Molecular Biology

REFERENCES

Jim Collins, Ph.D.	Termeer Professor of Medical Engineering and Science MIT jimjc@mit.edu, (617) 324-6607
Lingchong You, Ph.D.	Paul Ruffin Scarborough Associate Professor of Engineering Duke University you@duke.edu, (919) 660-8408
Edward Schwarz, Ph.D.	Burton Professor of Orthopaedics and Director of the Center for Musculoskeletal Research University of Rochester Medical Center Edward_Schwarz@urmc.rochester.edu, (585) 275-3063
Jaydeep Srimani, Ph.D.	Scientist I BioMarin Pharmaceutical jaydeep.srimani@gmail.com, (864) 650-7669
Glenn Tillotson, Ph.D.	Consultant GST Micro gtillotsonconsult@yahoo.com, (858) 361-3613
Joseph Kreitz	Undergraduate/prospective MIT graduate student Duke University joseph.kreitz@duke.edu, (612) 840-7229