

ALLISON J. LOPATKIN, PH.D.

Curriculum Vitae

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2009 Broadway
New York, NY 10027

ACADEMIC APPOINTMENTS

- Fall 2019 – Present **Barnard College, Columbia University**
Assistant Professor | Computational Biology, Dept. of Biology
- Fall 2017 – Fall 2019 **Massachusetts Institute of Technology**
Postdoctoral Fellow | 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**
Doctoral Candidate | Dept. of Biomedical Engineering
Dissertation: “Quantifying and inhibiting horizontal gene transfer-mediated antibiotic resistance.”
- Spring 2012 – Summer 2013 **URMC Department of Biomedical Engineering**
Research Assistant
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
Graduated *cum laude* with High Distinction

TEACHING AND PROFESSIONAL EXPERIENCE

- 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**
Early Career Panel Ambassador
Provides expert advice to direct the content of the site and contributes writing pieces on relevant topics

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| 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 |

SELECTED PUBLICATIONS

Name indicates student involvement
* indicates equal contribution

1. **A. J. Lopatkin** and J. J. Collins. “Predictive biology: modeling, understanding, and harnessing microbial complexity,” *Nature Microbiology Reviews* (2020). doi: <https://doi.org/10.1038/s41579-020-0372-5>
2. 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
3. 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.
4. **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
5. 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>
6. 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>

7. J. Stokes*, A. Gutierrez*, **A. J. Lopatkin**, I. Andersson, and J. Collins. "A high-throughput killing assay for screening antibiotic lethality," *Nature Methods* (2019). doi: 10.1038/s41592-019-0333-y
8. 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
9. 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.
10. 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.
11. **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.
12. 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.
13. 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.
14. **A. J. Lopatkin**, T. A. Sysoeva, 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.
15. **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.
16. 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.
17. 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.
18. 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.
19. 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.
20. **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 REVIEW

21. **A. J. Lopatkin**, S. C. Bening, A. L. Manson, A. M. Earl, A. H. Badram, and J. J. Collins. "Metabolic mutations in clinically relevant pathogens confer antibiotic resistance," (*Under review with revisions, Science*)
22. **A. J. Lopatkin** and Robert P. Smith. "Temporal decoupling of growth and metabolism under antibiotic treatment" (*Under Review, PLOS Computational Biology*)

23. **A. J. Lopatkin** and Jason H. Yang. “Nucleotide metabolism and antibiotic treatment failure” (*Under Review*, *Frontiers in Microbiology*)
24. 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” (*Under revisions*, *Molecular Systems Biology*)

PUBLICATIONS IN PREPARATION

25. A. Palomino, J. Morales, U. Zajmi, H. Prenskey, and **A. J. Lopatkin**. “The mobile metabolome of *Escherichia coli* plasmids”
26. **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”
27. S. C. Bening, I. W. Andrews, M. Hamblin, **A. J. Lopatkin**, and J. J. Collins. “Sensitizing tolerant bacteria to β -lactam antibiotics”

CONFERENCES/PRESENTATIONS

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| 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 talk “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

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| 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 |

HONORS, AWARDS, AND MEMBERSHIPS

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

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

Role: Collaborator

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)

SKILLS AND PROFICIENCIES

Mathematical Proficiencies: Linear algebra/linear systems, basic ordinary/partial differential equations, PK/PD modeling, stochastic processes, discrete/continuous analysis, advanced finite/agent-based modeling

Computational Proficiencies: Machine learning frameworks such as HCTSA and other ML toolboxes, bioinformatic analysis, simulation of biological processes, advanced image processing I MATLAB, Perl, CAD

Laboratory Proficiencies: Basic/advanced molecular and microbiology skills, including high throughput assay design with phenotypic or 'omics-based data collection, quantitative and innovative experimental design, clinical sample analysis, CRISPR/cas and other genetic engineering platforms, microfluidics, microscopy, implementing streamlined analysis pipelines, and other standard microbiological techniques

REFERENCES

Jim Collins, Ph.D.

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Lingchong You, Ph.D.

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Edward Schwarz, Ph.D.

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Musculoskeletal Research
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