

# John J. Dennehy

Queens College and The Graduate Center  
of The City University of New York  
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## Education

- 1997–2003 **PhD**, Clark University, Biology  
1995–1997 **MA**, University of Idaho, Zoology  
1991–1995 **BA**, Merrimack College, Biology

## Academic Appointments

- 2018–Pres. **Professor**, Queens College CUNY  
2013–2018 **Associate Professor**, Queens College CUNY  
2007–2013 **Assistant Professor**, Queens College CUNY  
2006–2007 **Postdoctoral Associate**, University at Albany SUNY  
2003–2006 **NSF Postdoctoral Fellow**, Yale University

## External Funding

- 2020 **National Institutes of Health National Institute of Allergy and Infectious Diseases Award** #[1R21AI156798](#) — *Novel Strategies for Treating Biofilm-Forming Pathogens with Phage Therapy* (PI, \$423,500).  
**QIAGEN: NGS Research Grant Award** — *Phylogenomics of SARS-CoV-2 Isolated from NYC Wastewater* (PI, \$20,000).  
**NSF Division of Environmental Biology Award** #[2032634](#) — *RAPID: Collaborative Research: Metapopulation Modeling to Develop Strategies to Reduce COVID-19 Transmission in Public Spaces* (PI, \$200,000).  
**New York City Department of Environmental Protection Project** #17-2273 — *Phylogenomic and Socioeconomic Correlates of COVID-19 Transmission in NYC* (PI, \$357,255).
- 2017 **National Institutes of Health National Institute of General Medical Sciences Award** #[1R01GM124446](#) — *Consequences and Control of Randomness in the Timing of Intracellular Events* (Co-PI, \$430,004).
- 2012 **National Science Foundation Faculty Early Career Award** #[1148879](#) — *CAREER: Population Dynamics and Evolutionary Ecology of Virus Emergence* (PI, \$713,900).
- 2009 **National Science Foundation Division of Molecular and Cellular Biosciences Award** #[0918199](#) — *Genetic and Molecular Basis of Bacteriophage Life History Variation* (PI, \$174,155).
- 2009 **National Science Foundation Division of Environmental Biology Award** #[0804039](#) *Research Assistantships for High School Students Supplement* (PI, \$17,848).
- 2008 Howard Hughes Medical Institute, Science Education Alliance, [SEA PHAGES program](#)
- 2008 **National Science Foundation Division of Environmental Biology Award** #[0804039](#) — *Population Dynamics and Evolution of Emerging Viruses* (PI, \$50,000).

2003 **National Science Foundation Division of Biological Infrastructure** Award #0310205 — *Adaptive Landscapes and the Evolution of Cooperation in RNA Viruses* (PI, \$160,000).

Publications (View in [Google Scholar](#), [ORCID iD](#), <sup>D,M,U,H</sup> = doctoral, masters, undergraduate, high school student author)

48. Kannoly S, <sup>U</sup>Oken G, <sup>U</sup>Shadan J, <sup>U</sup>Musheyev D, <sup>U</sup>Singh K, Singh A & **Dennehy JJ**. 2021. A single-cell approach reveals variation in cellular phage-producing capacities. [BioRxiv](#). (Submitted to *mSpectrum*).
47. Hoar C, Chauvin F, Katehis D, Clare A, McGibbon H, Castro E, Patinella S, **Dennehy JJ**, Trujillo M, Smyth DS, Silverman A. 2021. Monitoring SARS-CoV-2 in wastewater during New York City's second wave of COVID-19: Sewershed-level trends and relationships to publicly available clinical testing data. [Medrxiv](#). (In revision at *Environmental Science: Water Research & Technology*).
46. Skanata A, Spagnolo F, <sup>U</sup>Metz M, Smyth DS & **Dennehy JJ**. 2022. Humidity reduces rapid and distant airborne travel of viable viral particles in classroom settings. [BioRxiv](#). (In revision at *Environmental Science & Technology Letters*).
45. Kannoly S, Singh A & **Dennehy JJ**. 2021. An optimal lysis time maximizes bacteriophage fitness in quasi-continuous culture. [bioRxiv](#). (In press at *mBio*).
44. Kirby AE, Welsh R, Marsh Z, Yu AT, Vugia DJ, Boehm AB, Wolfe MK, White BJ, Matzinger S, Wheeler A, Bankers L, Andresen K, Slatas C, New York City Department of Environmental Protection, Gregory DA, Johnson MC, Trujillo M, Kannoly S, Smyth DS, **Dennehy JJ**, Hopkins L, Stadler L, Ensor K, Penn R, Brown P & Treangen T. 2022. Early evidence of the SARS-CoV-2 B.1.1.529 (Omicron) variant in community wastewater — United States, November–December 2021. [Morbidity and Mortality Weekly Report](#).
43. Burkhardt R, **Dennehy JJ**, Poon LLM, Saif LW, & Enquist LJ. 2022. Are COVID-19 vaccine boosters needed: the science behind boosters. [Journal of Virology](#).
42. Smyth DS, Trujillo M, Gregory DA, <sup>U</sup>Cheung K, <sup>U</sup>Gao A, <sup>U</sup>Graham M, Guan Y, <sup>D</sup>Hoxie I, Kannoly S, <sup>U</sup>Kubota N, Lyddon TD, <sup>U</sup>Markman M, <sup>U</sup>Rushford C, <sup>M</sup>San K, <sup>U</sup>Sompanya G, Spagnolo F, <sup>U</sup>Suarez R, Daniels M, Johnson MC & **Dennehy JJ**. 2022. Tracking cryptic SARS-CoV-2 lineages detected in NYC wastewater. [Nature Communications](#).
41. Spagnolo F, Trujillo M & **Dennehy JJ**. 2021. Why do antibiotics exist? [mBio](#).
40. <sup>D</sup>Hoxie I & **Dennehy JJ**. 2021. Rotavirus A genome segments show distinct segregation and codon usage patterns. [Viruses](#).
39. Trujillo M, <sup>U</sup>Cheung K, <sup>U</sup>Gao A, <sup>D</sup>Hoxie I, Kannoly S, <sup>U</sup>Kubota N, <sup>M</sup>San KM, Smyth DS & **Dennehy JJ**. 2021. Protocol for safe, affordable, and reproducible isolation and quantitation of SARS-CoV-2 RNA from wastewater. [PLOS ONE](#).
38. Pecson BM, Darby E, Haas CN, Amha Y, Bartolo M, Danielson R, Dearborn Y, Di Giovanni G, Ferguson C, Fevig S, Gaddis E, Gray D, Lukasik G, Mull B, Olivas L, Olivieri A, Qu Y, **SARS-CoV-2 Interlaboratory Consortium**. 2021. Reproducibility and sensitivity of 36 methods to quantify the SARS-CoV-2 genetic signal in raw wastewater: findings from an interlaboratory methods evaluation in the U.S. [Environmental Science: Water Research & Technology](#).
36. Dunning-Hotopp JC, Baltrus DA, Bruno VM, **Dennehy JJ**, Gill SR, Maresca JA, Matthijnsens J, Newton ILG, Putonti C, Rasko DA, Rokas A, Roux S, Stajich JE, Stedman KM, Stewart FJ, & Thrash JC. 2020. Best practices for successfully writing and publishing a genome announcement in Microbial Resource Announcements. [Microbiology Resource Announcements](#).

35. Kannoly S, <sup>U</sup>Gao T, Dey S, Wang I-N, Singh A & **Dennehy JJ**. 2020. Optimum threshold minimizes noise in timing of intracellular events. [\*iScience\*](#).
34. <sup>D</sup>Hoxie I & **Dennehy JJ**. 2020. Intragenic recombination influences rotavirus diversity and evolution. [\*Virus Evolution\*](#).
33. Baltrus DA, Cuomo CA, **Dennehy JJ**, Dunning-Hotopp JC, Maresca JA, Newton ILG, Rasko D, Rokas A, Roux S & Stajich JE. 2019. Future-proofing your Microbiology Resource Announcements genome assembly for reproducibility and clarity. [\*Microbiology Resource Announcements\*](#).
32. <sup>D</sup>Ghusinga K, **Dennehy JJ** & Singh A. 2017. First-passage time approach to controlling noise in timing of intra-cellular events. [\*Proceedings of the National Academy of Sciences USA\*](#).
31. **Dennehy JJ**. 2016. Evolutionary ecology of virus emergence. [\*Annals of the New York Academy of Sciences: The Year in Evolutionary Biology\*](#).
30. <sup>M</sup>Esposito LA, <sup>U</sup>Gupta S, <sup>U</sup>Prasad A, <sup>U</sup>Streiter F & **Dennehy JJ**. 2016. Evolutionary interpretations of mycobacteriophage biodiversity and host-range through the analysis of codon usage bias. [\*Microbial Genomics\*](#).
29. <sup>D</sup>Ahmadi M, Torshizi MAK, Rahimi S & **Dennehy JJ**. 2016. Prophylactic bacteriophage administration more effective than post-infection administration in reducing Salmonella enteritidis shedding in quails. [\*Frontiers in Microbiology\*](#).
28. Pope WH, Bowman CA, Russell DA, Jacobs-Sera D, **Science Education Alliance Phage Hunters Advancing Genomics and Evolutionary Science (SEA PHAGES)**, Phage Hunters Integrating Research and Education (PHIRE), Mycobacterial Genetics Course (MGC), Cresawn SG, Jacobs WR Jr, Hendrix RW, Lawrence JG & Hatfull GF. 2015. Whole genome comparison of a large collection of mycobacteriophages reveals a continuum of phage genetic diversity. [\*eLife\*](#).
27. <sup>D</sup>Ford BE, <sup>U</sup>Sun B, <sup>D</sup>Carpino J, <sup>U</sup>Chapler ES, <sup>U</sup>Ching J, <sup>U</sup>Choi Y, <sup>U</sup>Jhun K, <sup>U</sup>Kim JD, <sup>U</sup>Lallos GG, <sup>U</sup>Morgenstern R, <sup>U</sup>Singh S, <sup>U</sup>Theja S & **Dennehy JJ**. 2014. Frequency and fitness consequences of bacteriophage  $\phi 6$  host range mutations. [\*PLoS ONE\*](#).
26. **Dennehy JJ**. 2014. What ecologists can tell virologists. [\*Annual Review of Microbiology\*](#).
25. Singh A & **Dennehy JJ**. 2014. Stochastic holin expression can account for lysis time variation in the bacteriophage  $\lambda$ . [\*Journal of the Royal Society Interface\*](#).
24. Jordan TC, Burnett SH, Carson S, Caruso SM, Clase K, DeJong RJ, **Dennehy JJ**, Denver DR, Dunbar D, Elgin SCR, Findley AM, Gissendanner CR, Golebiewska UP, Guild N, Hartzog GA, Grillo WH, Hollowell GP, Hughes LE, Johnson A, King RA, Lewis LO, Li W, Rosenzweig F, Rubin MR, Saha MS, Sandoz J, Shaffer CD, Taylor B, Temple T, Vazquez E, Ware VC, Barker LP, Bradley KW, Jacobs-Sera D, Pope WH, Russell DA, Cresawn SG, Lopatto D, Bailey CB & Hatfull, GF. 2014. A broadly implementable research course for first-year undergraduate students. [\*mBio\*](#).
23. Hatfull GF, **Science Education Alliance Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) Program**, KwaZulu-Natal Research Institute for Tuberculosis and HIV (K- RITH) Mycobacterial Genetics Course, University of California Los Angeles Research Immersion Laboratory in Virology, Phage Hunters Integrating Research and Education (PHIRE) program. (2013). The complete genome sequences of 63 mycobacteriophages. [\*Genome Announcements\*](#).
22. **Dennehy JJ**, <sup>D</sup>Duffy S, O'Keefe KJ, Edwards SV & Turner PE. 2013. Frequent coinfection reduces RNA virus population genetic diversity. [\*Journal of Heredity\*](#).

21. **Dennehy JJ.** 2012. What can bacteriophages tell us about host-parasite coevolution? [\*International Journal of Evolutionary Biology.\*](#)
20. Hatfull GF, **Science Education Alliance Phage Hunters Advancing Genomics and Evolutionary Science Program**, the KwaZulu-Natal Research Institute for Tuberculosis and HIV Mycobacterial Genetics Course Students, and the Phage Hunters Integrating Research and Education Program. 2012. The complete genome sequences of 138 mycobacteriophages. [\*Journal of Virology.\*](#)
19. <sup>U</sup>Ching J, <sup>U</sup>Musheyev SA, <sup>H</sup>Chowdhury D, <sup>H</sup>Kim JA, <sup>U</sup>Choi Y & **Dennehy JJ.** 2012. Migration enhances adaptation in bacteriophage populations evolving in ecological sinks. [\*Evolution.\*](#)
18. <sup>U</sup>Li J & **Dennehy JJ.** 2011. Differential bacteriophage mortality on exposure to copper. [\*Applied and Environmental Microbiology.\*](#)
17. **Dennehy JJ** & Wang I-N. 2011. Factors influencing lysis time stochasticity in bacteriophage  $\lambda$ . [\*BMC Microbiology.\*](#)
16. **Dennehy JJ**, Friedenberg NA, McBride RC, Holt RD & Turner PE. 2010. Experimental evidence that source genetic variation drives pathogen emergence. [\*Proceedings of the Royal Society, B - Biological Sciences.\*](#)
15. <sup>D</sup>Khatchikian CE, **Dennehy JJ**, Vitek CJ & Livdahl TP. 2010. Environmental effects on bet hedging in Aedes mosquito egg hatch. [\*Evolutionary Ecology.\*](#)
14. Marshall JC, <sup>U</sup>Buttars PR, <sup>U</sup>Callahan T, **Dennehy JJ**, <sup>D</sup>Harris DJ, <sup>U</sup>Lunt B & <sup>U</sup>Shupe R. 2009. In the academic job market, will you be competitive? A case study in ecology and evolutionary biology. [\*Israel Journal of Ecology & Evolution.\*](#)
13. **Dennehy JJ.** 2009. Bacteriophages as model organisms for virus emergence research. [\*Trends in Microbiology.\*](#)
12. <sup>D</sup>Khatchikian CE, **Dennehy JJ**, Vitek CJ & Livdahl TP. 2009. Climate and geographic trends in hatch delay of the treehole mosquito, *Aedes triseriatus* Say (Diptera: Culicidae). [\*Journal of Vector Ecology.\*](#)
11. **Dennehy JJ**, Abedon ST & Turner PE. 2007. Host density impacts relative fitness of bacteriophage  $\Phi 6$  genotypes in structured habitats. [\*Evolution.\*](#)
10. **Dennehy JJ**, Friedenberg N, <sup>U</sup>Yang Y & Turner PE. 2007. Virus population extinction via ecological traps. [\*Ecology Letters.\*](#)
9. <sup>D</sup>Monello RJ, **Dennehy JJ**, <sup>U</sup>Wirsing AJ & Murray D. 2006. Growth and behavioral responses of tadpoles of two native frogs to an exotic competitor, *Rana catesbeiana*. [\*Journal of Herpetology.\*](#)
8. **Dennehy JJ**, Friedenberg N, <sup>U</sup>Yang Y & Turner PE. 2006. Bacteriophage migration via nematode vectors: host-parasite-consumer interactions in laboratory microcosms. [\*Applied and Environmental Microbiology.\*](#)
7. **Dennehy JJ**, Friedenberg N, Holt RD & Turner PE. 2006. Viral ecology and the maintenance of novel host use. [\*The American Naturalist.\*](#)
6. Evans MEK & **Dennehy JJ.** 2005. Germ banking: bet hedging and variable release from egg and seed dormancy. [\*Quarterly Review of Biology.\*](#)
5. **Dennehy JJ** & Turner PE. 2004. Reduced fecundity is the cost of cheating in RNA virus  $\Phi 6$ . [\*Proceedings of the Royal Society, B - Biological Sciences.\*](#)
4. **Dennehy JJ** & Livdahl TP. 2004. Polymorphic foraging behavior among *Caenorhabditis elegans*. Frequency- and density-dependent selection. [\*Journal of Nematology.\*](#)

3. **Dennehy JJ**, Robakiewicz P & Livdahl TP. 2001. Larval rearing conditions affect kin-mediated cannibalism in a treehole mosquito. [\*Oikos\*](#).
2. **Dennehy JJ**. 2001. Influence of social dominance rank on diet quality of pronghorn females. [\*Behavioral Ecology\*](#).
1. **Dennehy JJ** & Livdahl TP. 1999. First record of *Toxorhynchites rutilus* (Diptera: Culicidae) in Massachusetts. [\*Journal of the American Mosquito Control Association\*](#).

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### Conference Papers (Peer Reviewed)

4. Dey S, Kannoly S, Bokes P, **Dennehy JJ** & Singh A. 2021. Feedforward genetic circuits regulate the precision of event timing. [IEEE 2021 European Control Conference](#).
3. <sup>U</sup>Blotnick JA, <sup>D</sup>Vargas CA, **Dennehy JJ**, Zurakowski R & Singh A. 2017. The effect of multiplicity of infection on the temperateness of a bacteriophage: implications for viral fitness. [56th IEEE Conference on Decision and Control, Melbourne, Australia](#).
2. Conway JE, **Dennehy JJ** & Singh A. 2016. Optimizing phage  $\lambda$  survival in a changing environment: stochastic model predictions. [55th IEEE Conference on Decision and Control, Las Vegas, NV](#).
1. <sup>D</sup>Ghusinga KR, **Dennehy JJ** & Singh A. 2014. First passage time stochasticity in a gene network with feedback regulation. [Northeast Bioengineering Conference \(NEBEC\), Boston, MA](#).

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### Book Chapters

4. **Dennehy JJ** & Abedon ST. 2021. Bacteriophage ecology. In *Bacteriophages: Biology, Technology, Therapy*. Harper DR, Abedon ST, Burrowes B & McConville M (eds). [Springer Publishing](#).
3. **Dennehy JJ** & Abedon ST. 2021. Phage infection and lysis. In *Bacteriophages: Biology, Technology, Therapy*. Harper DR, Abedon ST, Burrowes B & McConville M (eds). [Springer Publishing](#).
2. **Dennehy JJ** & Abedon ST. 2021. Adsorption: phage acquisition of bacteria. In *Bacteriophages: Biology, Technology, Therapy*. Harper DR, Abedon ST, Burrowes B & McConville M (eds). [Springer Publishing](#).
1. <sup>D</sup>Ford BE, <sup>U</sup>Baloh M & **Dennehy JJ**. 2018. Evolutionary ecology of the viruses of microorganisms. In *Viruses of Microorganisms: Diversity, Molecular Biology and Applications*. Hyman P & Abedon ST (eds). [Caister Academic Press](#).

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### Book Reviews

2. **Dennehy JJ**. 2018. Review of *Thinking Like a Phage: The Genius of the Viruses That Infect Bacteria and Archaea*, Merry Youle, Wholon Press, 2018. Appearing in [Quarterly Review of Biology](#).
1. **Dennehy JJ**. 2008. Review of *Bacteriophage Ecology: Population Growth, Evolution, and Impact of Bacterial Viruses*. Abedon ST (ed.) *Advances in Molecular and Cellular Microbiology*, Vol. 15. Cambridge University Press, 2008. Appearing in [Quarterly Review of Biology](#).

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### Editorials

1. **Dennehy JJ**. 2020. Editorial on Wyllie et al. "Saliva is more sensitive for SARS-CoV-2 detection in COVID-19 patients than nasopharyngeal swabs" Appearing in [American Society for Microbiology COVID-19 Research Registry Editorial Volume 1](#).

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## Presentations (Past Five Years, #Presenting Author)

- 2021 Smyth DS, Trujillo M, <sup>U</sup>Cheung K, <sup>U</sup>Gao A, <sup>D</sup>Hoxie I, Kannoly S, <sup>U</sup>Kubota K, <sup>U</sup>Markman M, <sup>M</sup>San KM, <sup>U</sup>Sompanya G & #**Dennehy JJ**. Isolating and sequencing SARS-CoV-2 from wastewater to monitor variants of concern. World Microbe Forum (Online, Poster).
- 2019 #<sup>D</sup>Hoxie I & **Dennehy JJ**. Identifying rotavirus reassortment patterns using phylogenetic and *in vitro* analysis. ASM Microbe 2019, San Francisco, CA. (Poster).
- #<sup>U</sup>Urgiles C, <sup>U</sup>Alrubaye H, Kannoly S, Ghusinga K, Singh A & **Dennehy JJ**. Does cell growth rate affect lysis timing in *Escherichia coli* phage lambda? ASM Microbe 2019, San Francisco, CA. (Poster).
- #<sup>M</sup>Acquaotta M, Kannoly S, <sup>H</sup>Liu A, <sup>H</sup>Chasteen A, Anadon J & **Dennehy JJ**. Isolating phages with superpowers from Turkey Vultures. NYC SEA-PHAGES Symposium at Old Westbury College (Invited Talk).
- #<sup>U</sup>Musheyev D, <sup>U</sup>Fazylova R, <sup>U</sup>Shaden J, Kannoly S & **Dennehy JJ**. Overcoming phage tragedy of the commons through habitat fragmentation. NYC SEA-PHAGES Symposium at Old Westbury College. (Poster).
- #<sup>U</sup>Kubota N & **Dennehy JJ**. Mutations and selection in *Erwinia amylovora* phages adapting to host codon utilization. NYC SEA-PHAGES Symposium at Old Westbury College. (Poster).
- 2018 #<sup>U</sup>Urgiles C, <sup>U</sup>Alrubaye H, <sup>D</sup>Ghusinga K, Singh A & **Dennehy JJ**. Does cell growth rate affect lysis timing in *Escherichia coli* phage lambda? NYC SEA-PHAGES Symposium at Mount Saint Mary College (Invited Talk).
- #<sup>U</sup>Alrubaye H, Turner PE & **Dennehy JJ**. Mechanisms of RNA virus thermotolerance evolution. NYC SEA-PHAGES Symposium at Mount Saint Mary College (Best Poster Prize).
- #<sup>U</sup>Kubota N, <sup>M</sup>Rosario E & **Dennehy JJ**. Mutations and selection in *Erwinia amylovora* phages adapting to host's codon usage patterns. NYC SEA-PHAGES Symposium at Mount Saint Mary College (Best Poster Runner Up).
- #<sup>U</sup>Tandalam S, <sup>D</sup>Hoxie I, <sup>D</sup>Ford B, <sup>U</sup>Mu K & **Dennehy JJ**. Host-acquired factor impacts fitness on subsequent hosts in an RNA virus. NYC SEA-PHAGES Symposium at Mount Saint Mary College. (Poster).
- 2017 #**Dennehy JJ**, <sup>U</sup>Urgiles C, <sup>U</sup>Alrubaye H, <sup>D</sup>Ghusinga K, Singh A. Does cell growth rate affect event timing in *Escherichia coli*? Texas Phages 2017, College Station, TX. (Talk).
- #<sup>U</sup>Alrubaye H, <sup>U</sup>Urgiles C, <sup>D</sup>Ghusinga K, Singh A & **Dennehy JJ**. Dependency of bacteriophage lambda lysis time on host growth rate. Annual Biomedical Research Conference for Minority Students, Phoenix, AZ. (Poster).

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## Invited Talks (Past Five Years)

- 2021 *Environmental Protection & Disease Surveillance -The Emerging Field of Wastewater Epidemiology*, NSF Advanced Technological Education Conference.
- Control of Bacteriophage Lysis Timing*, 2<sup>nd</sup> International Conference on Bacteriophage Research, Society for Bacteriophage Research and Therapy. (Keynote).
- Evolution and Epidemiology of SARS-CoV-2*. COVID-19 Research Registry – A Year of Progress, American Society for Microbiology's World Microbe Forum.

- 2020 *Analyzing Virus Population Genetic Diversity Through Deep Sequencing*. Bioinformatics Boot Camp for Ecology and Evolution, CUNY.
- Inclusion for Scientists with Disabilities*. NYU Neuroscience Trainee Event, Neuroscience Graduate Program, New York University.
- A SARS-Cov-2 Vaccine Candidate Would Likely Match All Currently Circulating Variants*. [American Society for Microbiology's Virtual Journal Club](#).
- What does SARS-CoV-2 Evolution Mean for the Future of the Pandemic?* [At Home with Queens College Presents](#).
- 2017 *Event Timing in Single Cells*. Department of Biology, Kent State University.
- 2016 *Assessing Impacts of Integrating Research Experiences into the Curricula*, CUNY Research in the Classroom Workshop, John Jay College, CUNY.
- Codon Usage Bias and Bacteriophage Genomics*. ACS Middle Atlantic Annual Meeting
- Event Timing in Single Cells*. Department of Biology, Lehman College, CUNY.

## Media Coverage

### News Articles About Research

- [New York City Might Have Rat COVID, But It's Probably Fine](#), Caroline Spivak, *New York*, 2022/02/10
- [Mystery Lineages of Coronavirus Are Popping Up in NYC sewage](#), Stephanie Pappas, *Live Science*, 2022/02/05
- [4 'Cryptic' SARS-CoV-2 Variants Lurk in NYC Sewers](#), Eric Stann, *Futurity*, 2022/02/04
- [New York City's Rats Could Have Their Own Strain of COVID-19](#), Chris Mench, *Thrillist*, 2022/02/04
- [Mystery COVID 'Lineages' Found in Viral Fragments In Wastewater In California and New York](#), Jay Barmann, *SFist*, 2022/02/04
- [Scientists Detect Novel SARS-CoV-2 Variants in NYC Wastewater](#), Eric Stann, *Science Daily*, 2022/02/03
- [In New York City Sewage, a Mysterious Coronavirus Signal](#), Emily Anthes, *New York Times*, 2022/02/03
- [Omicron Was Probably in N.Y.C. Well Before the First U.S. Case Was Detected, Wastewater Data Suggest](#), Emily Anthes, *New York Times*, 2022/01/20
- [How Omicron Upended What We Thought We Knew About Natural Immunity](#), Maggie Koerth, *FiveThirtyEight.com*, 2022/01/19
- [In Sewage, Clues to Omicron's Surge](#), Emily Anthes, *New York Times*, 2022/01/19
- [Antimicrobial Resistance: The Silent Pandemic](#), Danielle Gerhard, *Drug Discovery News*, 2021/10/06
- [Animal Reservoirs of Covid-19 May Trigger New Rounds of Human Disease](#), William Haseltine, *Forbes*, 2021/09/13
- [Researchers Find Signs of COVID-19 Mutations in NYC Sewage, Pointing to Possible Dog and Rat Infections](#), Jacob Geanous and Derek Kravitz, *The City*, 2021/07/29
- [For the Delta Variant - and Future Threats - Scientists Eye the Toilet](#), Adam Smith, *TheStreet.com*, 2021/06/27
- [From the Wastewater Drain, Solid Pandemic Data](#), Emily Anthes, *New York Times*, 2021/05/07
- [Coronavirus May Be the Perfect Pathogen. Are Humans the Perfect Host?](#), Christopher Maag, *NorthJersey.com*, 2020/03/13
- [Viruses Would Rather Jump to New Hosts than Evolve with Them](#), Mallory Locklear, *Quanta* magazine, 2017/09/23; republished by [Wired](#).
- What kind of attraction is most important in your research? *Nautilus* magazine, January 2016.
- [Cancer, the Consummate Traveler](#), Catherine Gammon, *Nautilus* magazine, 2013/12/12
- [Virus Traps: Weapons of Mass Deception](#), Janet Ginsberg, *New Scientist*, 2007/10/27

- [Scientists Explore Ways to Lure Viruses to Their Death](#), Carl Zimmer, *New York Times*, 2007/03/27

### TV, Podcast, and Video Appearances

- Monologue, [Colbert Show, 2022/02/03](#)
- COVID Mystery Found in NYC Wastewater, [Fox5 10:00 Nightly News, 2022/02/03](#)
- TWiV 737: SARS-CoV-2 in NYC Wastewater. [This Week in Virology, 2021/04/01](#)
- Waste, Not: Sewage Holds Evidence of COVID-19. [QC Big Ideas, 2021/02/18.](#)
- Learning About COVID-19 with John Dennehy. [QC Podcast Lab, 2020/12/03.](#)
- Testing for COVID-19, Simply Science program. [CUNY TV, 2020/10/07.](#)
- Coronavirus: Are We Back Where We Started? [Science Vs podcast, 2020/07/02](#)
- Experimental Evolution. [Science Forward video series, 2014/05/01.](#)

## Courses Taught

Ecology and Evolution of Infectious Disease (2009, 2012, 2014, 2016, 2021)  
 Evolutionary Biology (2019)  
 Genomics Research Experience I: Phage Hunters (2009-2013)  
 Genomics Research Experience II: Phage Hunters (2010-2014)  
 General Microbiology (2008-2015, 2017-2022)  
 Introduction to Biology (2003)

## University Service

### Graduate Center, CUNY

Ecology and Evolutionary Biology Subprogram Advisory Committee (2019)  
 Graduate Center Biology Doctoral Program Executive Committee (2018–Pres.)  
 Deputy Executive Officer, Biology Doctoral Program (2017–Pres.)  
 Doctoral Program Faculty Review Committee 2015 – 2016  
 Molecular, Cellular and Developmental Biology Subprogram Advisory Committee (2010, 2019–2022)  
 Dissertation Fellowship Reviewer (2009, 2013, 2018)  
 Appointed, Molecular, Cellular and Developmental Biology Subprogram (2008)  
 Appointed, Ecology Evolutionary Biology and Behavior Subprogram (2007)

### Queens College, CUNY

NIH SCORE Coordination Committee (Chair, 2020–2021)  
 Graduate Advisory Committee (Member, 2009–2015; Chair, 2017–Pres.)  
 Science Organization of Minority Students (Faculty advisor; 2015–Pres.)  
 Minority Association of Premed Students (Faculty advisor, 2015–Pres.)  
 Dean of Math and Natural Sciences Search Committee (2015, 2019)  
 Founding Director of Undergraduate Research (2013–2018)

### Biology Department, Queens College, CUNY

Deputy Chair (2020–Pres.)  
 Maximizing Access to Research Careers (MARC) Steering Committee (2015–2020)  
 Personnel and Budget Committee (2014–Pres.)  
 Biology Honors Society Advisor (2014–Pres.)  
 Ecological Modeling Faculty Search Committee (2012–2013)  
 Supervisor, Core Facility for Imaging, Cellular and Molecular Biology (2011–2021)  
 Teaching Evaluation Committee - Adjunct and Graduate Student (2010–Pres.)  
 Fogel Endowment Fund Advisory Committee (Chair, 2010–Pres.)  
 Academic Advisement Committee (2008–2011)  
 Alumni & Endowment Funds—Subcommittee on Alumni Fund (2008–2011)

Core Facility Equipment Review Committee (2008–Pres.)  
Honors, Awards & Scholarships Committee (2008–2011)  
Evolutionary Developmental Biologist Faculty Search Committee (2008–2009)  
College Laboratory Technician Search Committee (2008)  
Biology Currents Editorial Board (2008–2011)  
Undergraduate Student Advisor (2007–2015)

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## Service to Profession

### **Ad Hoc Manuscript Referee**

American Naturalist (3), Animal Behavior, Antibiotics, Applied and Environmental Microbiology (3), Behavioral Ecology, Biological Journal of the Linnaean Society, BMC Evolutionary Biology (3), Communications Biology, Ecological Entomology, Ecology Letters, Evolution (8), FEMS Microbiology Ecology, FEMS Microbiology Letters, FEMS Microbiology Reviews, Frontiers in Microbiology (3), Genetics, Genome Biology and Evolution, Journal of Bacteriology (3), Journal of Biomedicine and Biotechnology, Journal of Molecular Evolution (2), Journal of Theoretical Biology, Journal of Virology, International Journal of Evolutionary Biology, International Society for Microbial Ecology Journal, mBio (3), Microbial Genomics, Microbial Informatics and Experimentation, Molecular Biology and Evolution, Nature Communications, Oikos, Peer J, PLoS Genetics (2), PLoS One (4), Science, Trends in Microbiology, Virologica Sinica, Virus Evolution, Viruses Basel (2)

### **Ad Hoc Grant Proposal Reviewer**

Polish National Science Centre (2017)  
National Science Foundation Division of Molecular and Cellular Biosciences (2010)  
The U.S. Army Research Office (2009)  
Civilian Research and Development Foundation (2009)  
CUNY Community College Collaborative Incentive Research Grant Program (2009)

### **Editorial**

Peer Community in Evolutionary Biology – Recommender (2022–Pres.)  
Quarterly Review of Biology – Book Review Consultant (2021–Pres.)  
ASM’s COVID-19 Research Registry – Curator (2020–Pres.)  
Oxford Academic Journals’ Virus Evolution – Associate Editor (2019–Pres.)  
ASM’s Microbiology Resource Announcements – Senior Editor (2018–23)

### **Mentoring**

Science Organization of Minority Students (2015–Pres.)  
Minority Association of Premed Students (2015–Pres.)  
Queensborough Bridges to the Baccalaureate program (2009–Pres.)  
Louis Stokes Alliance for Minority Participation in STEM (2009–Pres.)  
Maximizing Access to Research Careers (MARC, Steering Committee) (2007–2020)

### **Panel Member and Reviewer**

NIH Microbiology and Infectious Diseases Research study section (2021)  
NSF Postdoctoral Fellowships in Biology panel (2019)  
NIH Genetic Variation and Evolution (GVE) study section (2018)  
NSF Graduate Research Fellowship Program in Evolutionary Biology panel (2013)  
NSF Science and Technology Center Site Review Team for BEACON: An NSF Center for the Study of Evolution in Action at Michigan State University (2011)  
NSF Advisory Panel in DEB Evolutionary Processes Cluster (2010, 2016)

### **Symposia Organizer**

The Phage Club (2021-2022) – Monthly virtual phage research symposium  
Virus Ecology and Evolution Research symposium at CUNY ASRC (2019)  
Phage Hunters of New York at The Graduate Center of the City University of New York (2018)

[Stochastic Dynamics in Living Cells](#) at The Graduate Center of the City University of New York (2015)  
Phage Summit at Queens College of The City University of New York (2013)

### Website

[COVID Code](#) – This website contains recommendations for minimizing SARS-CoV-2 transmission in the built environment. The recommendations are based on mathematical modeling and simulation, and on experiments performed using a surrogate virus.

## Membership in Professional Societies

American Society for Microbiology (2008–Pres.)  
American Society of Naturalists (2005–Pres.)  
American Society for Virology (2019–Pres.)  
International Society for Viruses of Microorganisms (2017–Pres.)  
Society for the Study of Evolution (2005–Pres.)  
World Society for Virology (2019–Pres.)

## Students Mentored

### Summary

Mentored a total of 96 students (4 PhD, 13 MA, 58 UG, 21 HS)  
17 students from underrepresented groups  
13 undergraduates went on to research Master's or PhD programs

### Postdoctoral Associates (3 total)

Antun Skanata (2020–2021)  
Fabrizio Spagnolo (2019–2021)  
Sherin Kannoly (2018–Pres.)

### PhD Students (4 Total)

Irene Hoxie—Graduate Center of the City University of New York (2016–2021)  
• Postdoctoral Fellow, Krammer Lab, Icahn School of Medicine at Mount Sinai  
Emily Lin—Graduate Center of the City University of New York (2013–2016)  
• Research Assistant at Memorial Sloan Kettering Cancer Center  
Brian Ford—Graduate Center of the City University of New York (2011–2015)  
• Postdoctoral Fellow, University of Newcastle, UK  
James Carpino—Graduate Center of the City University of New York (2008–2014)  
• Entrepreneur in 3D Printing

### Masters Students (13 Total)

Aiden Stanciu (2022–Pres.)  
Yaxkin Meija (2021–Pres.)  
Stephanie Balkaran (2021–2022)  
Michael Acquavotta (2019–Pres.)  
JeanPaul Salinas (2019–2021)  
Donna Bedasee (2018 – 2020)  
• PhD Program at The Graduate Center of the City University of New York  
Aida Abbasiazam (2017–2019)  
Elsa Rosario (2017–2019)  
• NSF GRFP in STEM Education, 2019  
Zachary Way (2016–2019)  
• Best Poster Honorable Mention, 31st Annual Sigma Xi Research Day, Queens College Chapter (2017)

Lauren Esposito (2014–2016)

- MPH program at Mt. Sinai College of Medicine '18
- Senior Analyst at Memorial Sloan Kettering Cancer Center

Gregory Lallo (2011–2013)

- Senior Research Technician, Regeneron Pharmaceuticals

Jinyu Li (2010–2013)

- Lab Technician at Accupath Laboratories

Bruce Sun (2009–2011)

- Senior Research Technician, Blue Rock Therapeutics

### **PhD Student Rotations (6 Total)**

Zubaida Islam—Graduate Center of the City University of New York (2021)

Malini Prasad—Graduate Center of the City University of New York (2021)

Anna Flury—Graduate Center of the City University of New York (2021)

Makayla Braunlin—Graduate Center of the City University of New York (2020)

Johanna Bensel—Graduate Center of the City University of New York (2019)

Niklas Janisch—Graduate Center of the City University of New York (2016)

Emily Sible—Graduate Center of the City University of New York (2016)

Sruti Patoori—Graduate Center of the City University of New York (2014)

Glennon Bythroe—Graduate Center of the City University of New York (2013)

### **Dissertation or Thesis Committee Membership (12 Total)**

Charles Robinson—PhD Biology, The Graduate Center CUNY (In progress)

LiYong Cao—MA Biology, Queens College (2021)

Guy Mason—PhD Biology, New York University (In progress)

Emma Ciccarelli—PhD Biology, The Graduate Center CUNY (In progress)

Jonathan Goldstein—MA Biology, Queens College (2014)

Tatiana Garces—MA Biology, Queens College (2014)

Maylalyal Salameh—MA Biology, Queens College (2014)

Huansheng Cao—PhD Biology, Fordham University (2012)

Sai Theja—MA Biology, Queens College (2011)

Wassem Moarsi—MA Biology, Queens College (2010)

Ryan Vinberg—MA Biology, Queens College (2010)

Akash Sookdeo—MA Biology, Queens College (2010)

Enobong Shammah—MA Biology, Queens College (2009), Committee Chair

### **Undergraduate Students (58 Total)**

Rabab Mahdi (2021–Pres.)

Michael Loccisano (2021–Pres.)

Shyanon Rai (2021–Pres.)

Alexandra Goldblatt (2021–Pres.)

Naseerah Juman (2021–Pres.)

Mazharul Mahe (2020–Pres.)

- Honors in the Mathematical and Natural Sciences

Izumi Kuremoto (2019–2020)

Kevin Singh (2019–Pres.)

- Honors in the Mathematical and Natural Sciences

Siddharth Malviya (2019)

Jon Shaden (2018–2021)

- Honors in the Mathematical and Natural Sciences

Roberta Fazylova (2018–2020)

Gloria Stoyanova (2018–2019)

- Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
  - PhD Program at Albert Einstein College of Medicine
- Kristen Cheung (2018–2020)
- Honors in the Mathematical and Natural Sciences
  - Macaulay Honors College
- Michelle Markman (2018–2021)
- Honors in the Mathematical and Natural Sciences
  - Macaulay Honors College
- Anna Gao (2017–2020)
- Tevin Lynch (2017–2019)
- Honors in the Mathematical and Natural Sciences
  - Feigelson Award (Best Undergraduate Research in Biology, 2019)
- David Musheyev (2017–2021)
- Honors in the Mathematical and Natural Sciences
  - Macaulay Honors College
- Gabriella Oken (2017–2020)
- Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
- Nanami Kubota (2017–2020)
- Honors in the Mathematical and Natural Sciences
  - Macaulay Honors College
  - 2nd Prize Best Poster Runner Up, NYC SEA-PHAGES Symposium at Mount Saint Mary
  - 38th Annual Meeting of the American Society for Virology Travel Award
  - PhD Program at University of Pittsburgh
- Hisham Alrubaye (2016–2018)
- Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
  - Yale University Summer Undergraduate Research Program
  - 1st Prize Best Poster, NYC SEA-PHAGES Symposium at Mount Saint Mary College
  - PhD Program at University of Pittsburgh
- Sangeetha Tandalam (2015–2018)
- Feigelson Award (Best Undergraduate Research in Biology, 2018)
  - Research Technician, Weill Cornell Medicine
  - Creighton University School of Medicine
- Lixing He (2015)
- Vincent-Joe Cali (2015–2018)
- Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
  - Rutgers University Summer Undergraduate Research Program
  - Colwin Award (Best Undergraduate Research in Biology, 2018)
  - Albert Einstein College of Medicine
- Carmen Urgiles (2015–2018)
- Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
  - Invited Talk, NYC SEA-PHAGES Symposium at Mount Saint Mary
  - American Society for Microbiology Research Capstone Program Fellowship
  - Lab Technologist at Neochromosome, Inc.
- Boryana Baric (2014–2015)
- Paola Lozada (2014–2016)

- Certified Medical Assistant, ENT and Allergy Associates
- Peter Scimeni (2014–2015)
- Zachary Way (2014–2016)
- Best Poster Honorable Mention, 31st Annual Sigma Xi Research Day, Queens College Chapter (2017)
  - Colwin Award (Best Undergraduate Research in Biology, 2017)
- Jonathan Itzhakov (2014–2015)
- Aaron Wadler (2014–2015)
- Physician Assistant at Northwell Health
- Fraida Streiter (2014–2016)
- Elsa Rosario (2014–present)
- Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
  - Best Poster in Microbiology prize, ABRCMS 2014, San Antonio, TX
  - Best Poster in Biology prize, 23rd Annual CSTEP Conference, Lake George, NY
  - MS Queens College '19
- Daniel Grossman (2013–2014)
- Ashley Prasad (2013–2016)
- Honors in the Mathematical and Natural Sciences
- Rahat Shah (2013–2015)
- Medical Assistant, NorthShore University Health System
- David Toubiyan (2013–2015)
- St. Georges School of Medicine '19
- Marko Baloh (2012–2016)
- PhD Program at Texas A&M University
- Qainat Shah (2012–2015)
- Award for Best Undergraduate Research in Neuroscience
  - 1st runner up, Best Poster Presentation, QC Undergraduate Research Day 2014
  - Maximizing Access to Research Careers (MARC)
  - Honors in the Mathematical and Natural Sciences
  - Yale University Summer Undergraduate Research Program
  - MPH program at Mt. Sinai College of Medicine '17
  - Albany Medical College '22
- Lauren Esposito (2011–2014)
- Feigelson Award (Best Undergraduate Research in Biology, 2014)
  - MS Queens College '16
  - MPH program at Mt. Sinai College of Medicine '18
- Swati Gupta (2011–2015)
- Thomas Jefferson University's Accelerated Professional Master's program '18
  - Cytologist at Northwell Health
- Elizabeth Chapler (2011–2013)
- Honors in the Mathematical and Natural Sciences
  - Physician Assistant program at Pace University '15
  - Physician Assistant at Montefiore Medical Center
- Stephanie Gampel (2011–2012)
- Lucile Lindberg Scholarship
  - Albert Einstein College of Medicine '16
- Rachel Morgenstern (2011–2012)
- MPH program at Columbia University Mailman School of Public Health '15
  - Clinical Research Coordinator at Hospital for Special Surgery

Lauren Mordukhaev (2010–2013)

- Honors in the Mathematical and Natural Sciences, Macaulay Honors College
- Charles Darwin Award (Highest GPA, QC Biology Department)
- Hofstra College of Medicine '18

Kevin Mu (2010–2013)

- Honors in the Mathematical and Natural Sciences
- Macaulay Honors College Macaulay Honors College Thesis Award
- Feigelson Award (Best Undergraduate Research in Biology, 2013)
- Lab Technician, Poss Lab, Center for Infectious Disease Dynamics, Penn State University
- Cornell Veterinary College '18
- Veterinarian, Private Practice

Jane Ching (2010–2012)

- PharmD University of Maryland '16
- Solid Organ Transplant Clinical Pharmacy Specialist at Methodist Healthcare System

Shalini Singh (2010–2011)

- NSF-STEP Queensborough Bridge Fellowship for Summer Research (2010)
- Winner of 1st Prize for Best Poster at the 43rd Annual Meeting of the Metropolitan Association of College and University Biologists
- City College '15
- Adjunct Lecturer, Queensborough Community College

Avi Bitterman (2010–2011)

- Charles Darwin Award (Highest GPA, QC Biology Undergraduates)
- Jefferson Medical College '16
- Dermatologist, Mt. Sinai

David Lee (2009–2011)

- Honors in the Mathematical and Natural Sciences

Jinyu Li (2009–2011)

- Lab Technician at Accupath Laboratories

Kevin Jhun (2009–2012)

- Honors in the Mathematical and Natural Sciences, Macaulay Honors College
- University Scholar Award, Queens College
- Best poster prize, 2012 Sigma Xi conference
- Feigelson Award (Best Undergraduate Research in Biology, 2012)
- PhD program at Mt. Sinai Medical College
- Scientist at Celularity, Inc.

Mark Johnson (2009)

Carlos Romero (2009)

- MA Biology Queens College '15
- Junior Project Lead at Harvard LabXchange

Emilsie Leconte (2009)

Guylda Alphonse (2009)

- Staff Nurse at Upper East Side Rehabilitation and Nursing Center

Jung David Kim (2009–2011)

- NSF-STEP Queensborough Bridge Fellowship for summer research (2009)
- Summer Program for Undergraduate Research Award (2010)
- EMT, Northshore LIJ Medical Center

Svetlana Musheyev (2008–2009)

- Feigelson Award (Best Undergraduate Research in Biology, 2009)
- NYU School of Dentistry '15
- Pediatric Dentist, Private Practice

Sai Theja (2008–2009)

- NSF-STEP Queensborough Bridge Fellowship for Summer Research (2009)
- Summer Program for Undergraduate Research Award (2009)

**High School Students (21 Total)**

Monil Patel, Townsend Harris (2020- present)

Alexander Chasteen, Bronx Science (2019–2021)

- Yale University '25

Andrew Liu, Bronx Science (2018–2020)

Maressa Cumbermack, Townsend Harris (2016–2017)

- Princeton University '21

Darsiya Krishnathasan, Townsend Harris (2016–2017)

- Stony Brook University '21

David Musheyev, Townsend Harris (2016–2017)

- Macaulay Honors College '21

Sasha Balkaran, Townsend Harris (2016–2017)

- Macaulay Honors College '21

David Zarowin, Townsend Harris (2015)

- New York University '20

Samia Abedin, Townsend Harris (2014)

- Columbia University '19
- Corporate Paralegal at Weil, Gotshal, and Manges

Nimrod Gozum, Townsend Harris (2012–2013)

- NYCSEF Semifinalist/Second Award in Microbiology
- Stony Brook University '17

Alan Chu, Francis Lewis (2012)

- SUNY Binghamton '18

Shanawaj Khair, John Bowne (2011–2012)

- 2012 NYSEF Finalist
- Intel International Science and Engineering Fair 2012
- Best poster prize, 2012 Sigma Xi conference
- Stony Brook University '16
- MD-PhD Candidate at the University of Colorado School of Medicine

Daniel Arango, John Bowne (2011–2012)

- 2012 NYSEF Finalist
- Intel International Science and Engineering Fair 2012
- Best poster prize, 2012 Sigma Xi conference
- Queensborough Community College '14

Deborah Sands, John F. Kennedy (2008)

- Cornell '14
- University of Pennsylvania '19
- Associate at Sidley Austin LLP

Shajoti Rahman, Townsend Harris (2008-10)

- Hunter College, CUNY '14
- SUNY Downstate College of Medicine '19
- MD at Sinai EM

Dipabali Chowdhury, Townsend Harris (2008–10)

- NYCSEF Semifinalist/Second Award in Microbiology
- Cornell University '14
- Learning & Development at MongoDB

Katherine Valles, Townsend Harris (2008–10)

- NYCSEF Semifinalist/Second Award in Microbiology
- Fordham University '14
- IRTA Fellow at NIH
- Albert Einstein College of Medicine '21

Ashraf Hussain, Townsend Harris (2008-10)

- Queens College '13
- Long Island University '16
- NYC Teacher

Lydia Wu, Townsend Harris (2007–2009)

- Sophie B. Davis School of Biomedical Education, CUNY '13
- Albany Medical College '16
- MD at Weill Cornell

Julie Kim, Townsend Harris (2007–2009)

- NYCSEF Semifinalist
- Carnegie Mellon University '13
- Feminist Writer & Organizer

Aneury Hernandez, Townsend Harris (2007–2009)

- NYCSEF Semifinalist/Third Award in Microbiology
- University of Michigan '13
- Mt. Sinai Medical College '19
- MD at Mt. Sinai

### **Visiting Scientists**

Dr. Fabrizio Spagnolo—Long Island University: Post (2021–present)

Dr. Monica Trujillo—Queensborough Community College (2020–present)

Dr. Saima Cheema—Queens College (2016–2018)

Dr. Rafael Ovalle—Brooklyn College (2012–2013)

Dr. Gillian Ryan—Dalhousie University (2009)

Dr. Sophie Rigvava—George Eliava Institute of Bacteriophages, Microbiology and Virology (2009)