MEDINI K. ANNAVAJHALA, PhD

Date of Preparation: January 5, 2021

Academic Appointments and Other Work Experience

12/2018 – Present	Infectious Disease Division, Columbia University *Postdoctoral Research Fellow*	New York, NY
06/2017 – 11/2018	Infectious Disease Division, Columbia University *Postdoctoral Research Scientist*	New York, NY
08/2012 – 05/2017	Dept. of Earth and Environ. Eng., Columbia University *Graduate Research Assistant*	New York, NY
10/2010 – 05/2012	Dept. of Chemistry, Carnegie Mellon University *Undergraduate Research Assistant*	Pittsburgh, PA
06/2010 – 08/2010	Proctor & Gamble, Home Care Research & Development *Products Research Intern*	Cincinnati, OH

Education

08/2012 – 05/2017 Columbia University, School of Engineering and Applied Sciences
Department of Earth and Environmental Engineering
MS, May 2014 — New York, NY
PhD, May 2017 — New York, NY
Sponsor: Dr. Kartik Chandran
Thesis: "Meta-omics-derived structure, function, and activity of mixed microbial communities driving biological nutrient removal and recovery"

08/2008-12/2011 Carnegie Mellon University, Mellon College of Science
Department of Biological Sciences & Department of Philosophy
BS, December 2011 — Pittsburgh, PA

Honors and Awards

2019 Up-Goer Five Thing Symposium, ASM Microbe 2019
Science communication symposium where two teams presented research abstracts using only 1,000 most commonly used words in English. I was on the winning team (Team People Still Learning) and won both team MVP and best phrase substitution based on audience voting.

2019 Outstanding Abstract Award, ASM Microbe 2019

2018 Conference Participation Grant, International Microbiome in HIV Workshop

2017 Herbert H. Kellogg Fellowship, Columbia School of Engineering and Applied Sciences
Recognizing distinguished ability as a teaching assistant

2012 – 2016 Presidential Fellowship, Columbia School of Engineering and Applied Sciences
Selected by a panel of SEAS faculty for the distinguished Presidential Fellowship as an incoming MS/PhD candidate due to "outstanding potential for graduate

research and training." The fellowship provided full financial support to pursue my doctoral research with intellectual freedom in any field within SEAS.

2014 – 2015 International Fellows Program, Columbia School of International and Public Affairs

Selected as part of an exclusive multidisciplinary group of 30 students to participate in discussions on the role of the US in international affairs.

2012 Phi Beta Kappa Honors Society induction, Carnegie Mellon University

2012 Phi Kappa Phi Honors Society induction, Carnegie Melon University

2012 University Honors, Carnegie Mellon University

2012 Mellon College of Science Honors, Carnegie Mellon University

2012 Outstanding Undergraduate Research, Carnegie Mellon University

2012 Outstanding Academic Achievement, Carnegie Mellon University

2008 – 2011 Science & Humanities Scholar, Carnegie Mellon University

Academic & Public Service

2019 ***Workshop Instructor*, Biotech without Borders** **New York, NY**

Created and taught a 2.5-hour workshop, "Genomics in the human body: host genetics and the gut microbiome," at the community biotech lab open to the public, covering whole-exome data analysis to identify potentially pathogenic variants and metagenomics of the gut microbiome.

2019 ***Supervisory Scientist*, Blueprint Earth** **Mojave National Preserve, CA**

I was selected by the non-profit organization Blueprint Earth to serve as a Supervisory Scientist in Hydrology for a 5-day field expedition in the Mojave National Preserve. The mission of Blueprint Earth is to catalog unique ecosystems through atmospheric, geological, hydrological, zoological, and botanical testing in order to better understand complex systems-level interactions in the natural environment. I designed a protocol for sampling, culturing, and sequencing of bacteria in water sources around the study area and helped supervise 12 undergraduate and post-graduate students during the trip, providing them with hands-on experience in field research.

2014 – 2015 ***Water Programs Officer*, FACE Africa** **Rivercess, Liberia; New York, NY**

In my role on the Executive Board of the grassroots non-profit organization FACE Africa, I oversaw planning and implementation of clean drinking water and sanitation facilities in Rivercess County, Liberia. My responsibilities included the selection of appropriate project sites based on local public health need and engineering considerations; oversight of project implementation by local teams; management of up to $100,000 grants; and reporting to governmental agencies and donors.

2010 – 2012 Biology Outreach Programs **Pittsburgh, PA**

Introduced local high school students to biology laboratory practices through the Carnegie Mellon University Department of Biological Sciences.

2009 – 2011 AmeriCorps Scholar in Service **Pittsburgh, PA**

Selected as the Community Service Intern at Carnegie Mellon University through AmeriCorps. I networked with local non-profit organizations and organized targeted local service experiences for all campus student groups.

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Professional Organizations and Societies

Memberships

2019 – Present	Association for Clinical and Translational Science (ACTS)
2018 – Present	American Society of Microbiology
2016 – Present	American Association for the Advancement of Science (AAAS)
2016 – Present	Water Environment Federation (WEF)
2016 – Present	NY Water Environment Association (NYWEA)

Ad hoc Reviewer

2020	*Antimicrobial Agents & Chemotherapy*
2019	*mSphere, Journal of Global Antimicrobial Resistance*
2017	*Environmental Science & Technology*
2016	*Chemical Engineering Journal*

Fellowship and Grant Support

Current Support

12/2018 – 12/2020 TRANSFORM TL1, Irving Institute for Clinical and Translational Research Columbia University Irving Medical Center; Role: Postdoctoral Fellow "Microbial metagenomic pathways contributing to chronic inflammation in patients with HIV."

Past Support

2011	Howard Hughes Medical Institute (HHMI) Researcher Grant
2011	Howard Hughes Medical Institute (HHMI) Small Undergraduate Research Grant (SURG)

Teaching Experience and Responsibilities

06/2017 – 06/2018	Microbiome Working Group Research seminar series *Organize monthly educational conferences on topics of microbiome research at Columbia University Medical Center*	New York, NY
09/2016 – 12/2016	Dept. of Earth and Environ. Eng., Columbia University *Teaching Assistant, Aquatic Chemistry*	New York, NY
01/2012 – 05/2012	Dept. of Biological Sciences, Carnegie Mellon University *Teaching Assistant, Experimental Techniques in Molecular Biology*	Pittsburgh, PA
09/2011 – 12/2011	Dept. of Biological Sciences, Carnegie Mellon University *Teaching Assistant, Experimental Biochemistry*	Pittsburgh, PA
08/2010 – 12/2010	Dept. of Philosophy, Carnegie Mellon University *Teaching Assistant, Ethical Judgments in Professional Life*	Pittsburgh, PA

MEDINI K. ANNAVAJHALA, PhD

Publications

A. Original, Peer-Reviewed Research Publications

1. Miller EH, Zucker J, Castor D, **Annavajhala MK**, Sepulveda JL, Green DA, Whittier S, Scherer M, Medrano N, Sobieszczyk ME, Yin MT, Kuhn L, Uhlemann A-C. Pre-test symptom duration and cycle threshold values for SARS-CoV-2 reverse transcription-PCR (RT-PCR) predict COVID-19 mortality. *Open Forum Infect. Dis.* 2021; doi: 10.1093/ofid/ofab003.

2. Agrawal S, Weissbrodt DG, **Annavajhala MK**, Jensen MM, Carvajal Arroyo JM, Wells G, Chandran K, Vlaeminck SE, Terada A, Smets BF, Lackner S. Time to act – assessing variations in qPCR analyses in biological nitrogen removal with examples from partial nitritation/anammox systems. *Water Res.* 2021; 190:116604. doi: 10.1016/j.watres.2020.116604

3. Gomez-Simmonds A, **Annavajhala MK**, McConville T, Dietz D, Shoucri S, Laracy J, Rozenberg F, Nelson B, Greendyke W, Furuya EY, Whittier Susan, Uhlemann A-C. Carbapenemase-producing Enterobacterales causing secondary infections during the COVID-19 crisis at a New York City hospital. *J. Antimicrob. Chemother.* 2020; doi: 10.1093/jac/dkaa466.

4. McConville TH, **Annavajhala MK**, Giddins MJ, Macesic N, Herrera CM, Rozenberg FD, Bhushan GL, Ahn D, Mancia F, Trent MS, Uhlemann A-C. CrrB positively regulates high-level polymyxin-resistance and virulence in *Klebsiella pneumoniae. Cell Rep.* 2020; 3:108313. doi: 10.1016/j.celrep.2020.108313

5. Kundu S, Shen L, Somasundar Y, **Annavajhala MK**, Ryabov A, Collins T. TAML- and Buffer-Catalyzed Oxidation of Picric Acid by H_2O_2: Products, Kinetics, DFT and the Mechanism of the Dual Catalysis. *Inorg. Chem.* 2020; 59(18):13223-13232. doi: 10.1021/acs.inorgchem.0c01581

6. **Annavajhala MK**, May M, Compres G, Freedberg DE, Graham R, Korem T, Stump S, Uhlemann A-C, Abrams JA. Relationship of the Esophageal Microbiome and Tissue Gene Expression and Links to the Oral Microbiome: A Randomized Clinical Trial. *Clin. Transl. Gastroenterol*. 2020. In Press

7. Papapanou PN, Park H, Cheng B, Kokaras A, Paster B, Burkett S, Watson CW-M, **Annavajhala MK**, Uhlemann A-C, Noble JM. Subgingival microbiome and clinical periodontal status in an elderly cohort: The WHICAP ancillary study of oral health. *J. Periodontol.* 2020; 91(S1):1-12. doi: 10.1002/JPER.20-0194

8. **Annavajhala MK**, Khan SD, Sullivan SB, Shah J, Pass L, Kister K, Kunen H, Chiang V, Monnot G, Ricupero CT, Mazur R, Gordon P, de Jong A, Wadhwa S, Yin MT, Demmer RT, Uhlemann A-C. Oral and gut microbial diversity and immune regulation in patients with HIV on antiretroviral therapy. *mSphere* 2020; 5(1):e00798-19. doi: 10.1128/mSphere.00798-19

9. **Annavajhala MK**, Gomez-Simmonds A, Macesic N, Sullivan SB, Kress A, Khan SD, Giddins MJ, Stump S, Kim GI, Narain R, Verna EC, Uhlemann A-C. Colonizing multidrug-resistant bacteria and the longitudinal evolution of the intestinal microbiome after liver transplantation. *Nat. Comm.* 2019; 10(1):4715. doi: 10.1038/s41467-019-12633-4

10. LaCarpia F, Wojczyk B, **Annavajhala MK**, Rebbaa A, Culp-Hill R, D'Alessandro A, Freedberg D, Uhlemann A-C, Hod E. Transfusional iron overload and intravenous iron infusions modify the mouse gut microbiota similarly to dietary iron. *NPJ Biofilms Microbiomes* 2019; 5:26. doi: 10.1038/s41522-019-0097-2

11. Macesic N, Nelson B, McConville TH, Giddins MJ, Green DA, Stump S, Gomez-Simmonds

A, **Annavajhala MK**, Uhlemann A-C. Emergence of polymyxin resistance in clinical *Klebsiella pneumoniae* through diverse genetic adaptations: a genomic, retrospective cohort study. *Clin. Inf. Dis*. 2020; 70(10):2084-2091. doi: 10.1093/cid/ciz623

12. Macesic N, Khan S, Giddins MJ, Freedberg D, Whittier S, Green D, Furuya EY, Verna EC, **Annavajhala MK**, Gomez-Simmonds A, Uhlemann A-C. *Escherichia coli* harboring *mcr-1* in a cluster of liver transplant recipients: detection through active surveillance and whole genome sequencing. *Antimicrob. Agents Chemother*. 2019; 63(6):e02680-18. doi: 10.1128/AAC.02680-18

13. Gabryszewski SJ, Wong Fok Lung T, **Annavajhala MK**, Tomlinson KL, Riquelme SA, Khan IN, Noguera LP, Wickersham M, Zhao A, Mulenos AM, Peaper D, Koff JL, Uhlemann AC, Prince A. Metabolic adaptation supports persistent methicillin-resistant *Staphylococcus aureus* pulmonary infection. *Am. J. Respir. Cell Mol. Biol.* 2019; 61(2):185-197. doi: 10.1165/rcmb.2018-0389OC

14. Brotto AC*, **Annavajhala MK***, Chandran K. Metatranscriptomic investigation of adaptation in NO and N_2O production from a lab-scale nitrification process upon repeated exposure to anoxic-aerobic cycling. *Front. Microbiol*. 2018; 9:3012. doi:10.3389/fmicb.2018.03012 ***contributed equally**

15. **Annavajhala MK**, Kapoor V, Santo-Domingo J, Chandran K. Structural and functional interrogation of selected biological nitrogen removal systems in the United States, Denmark, and Singapore using shotgun metagenomics. *Front. Microbiol*. 2018; 9:2544. doi: 10.3389/fmicb.2018.02544

16. Gomez-Simmonds A, Stump S, Giddins MJ, **Annavajhala MK**, Uhlemann AC. Clonal background, resistance gene profile, and porin gene mutations modulate *in vitro* susceptibility to imipenem/relebactam in diverse Enterobacteriaceae. *Antimicrob. Agents Chemother*. 2018; 62(8):e00573-18. doi: 10.1128/AAC.00573-18

17. Freedberg DE, Zhou MJ, Cohen ME, **Annavajhala MK**, Khan S, Moscoso DI, Brooks C, Whittier S, Chong DH, Uhlemann AC, Abrams JA. Pathogen colonization of the gastrointestinal microbiome at intensive care unit admission and risk for subsequent death or infection. *Intensive Care Med*. 2018; 44:1203-1211. doi: 10.1007/s00134-018-5268-8

18. Gomez-Simmonds A*, **Annavajhala MK***, Wang Z*, Macesic N, Hu Yue, Giddins MJ, O'Malley A, Toussaint NC, Whittier S, Torres VJ, Uhlemann A-C. Genomic and geographic context for the evolution of high-risk carbapenem-resistant *Enterobacter cloacae* complex clones ST171 and ST78. *mBio* 2018; 9:e00542-18. doi: 10.1128/mBio.00542-18 ***contributed equally**

19. **Annavajhala MK**, Kapoor V, Santo-Domingo J, Chandran K. Comammox Functionality Identified in Diverse Engineered Biological Wastewater Treatment Systems. *Environ. Sci. Technol. Lett*. 2018; 5(2):110-116. doi: 10.1021/acs.estlett.7b00577

20. Giddins MJ, Macesic N, **Annavajhala MK**, Stump S, Khan S, McConville TH, Gomez-Simmonds A, Uhlemann A-C. Successive emergence of ceftazidime-avibactam resistance through distinct genomic adaptations in bla_{KPC}-2-harboring *Klebsiella pneumoniae* ST307. *Antimicrob. Agents Chemother.* 2018; 62(3):e02101-17. doi: 10.1128/AAC.02101-17

21. Kundu S, **Annavajhala MK**, Kurnikov IV, Ryabov AD, Collins TJ. Experimental and Theoretical Evidence for Multiple FeIV Reactive Intermediates in TAML Activator Catalysis: Rationalizing a Counterintuitive Reactivity Order. *Chem. Eur. J.* 2012*;* **18**(33):10244-10249.

B. Case Reports

1. DiFranza L, **Annavajhala MK**, Uhlemann A-C, Green D. The Brief Case: A Maggot Mystery: *Ignatzschineria* larvae sepsis secondary to an infested wound. *J Clin Microbiol* 2020; In Press.

C. Pre-prints

1. Park M-R, **Annavajhala MK**, Chandran K. Meta-azotomics of engineered wastewater treatment processes reveals differential contributions of established and novel models of N-cycling. *bioRxiv* 2020. doi: https://doi.org/10.1101/2020.08.25.229054

D. Reviews

1. **Annavajhala MK,** Gomez-Simmonds A, Uhlemann A-C. Multidrug-Resistant Enterobacter cloacae Complex Emerging as a Global, Diversifying Threat. *Front. Microbiol.* 2019; 10:44. doi: 10.3389/fmicb.2019.00044

E. Oral Presentations

1. **Annavajhala MK**, Park H, Gomez-Simmonds A, Macesic N, Khan SD, Rozenberg FD, Giddins MJ, Stump S, Uhlemann A-C. Gut microbiome signatures associated with colonization by high-risk multidrug-resistant *Klebsiella pneumoniae* and *Escherichia coli* clones after liver transplantation. ASM Microbe 2020 ***Moved online due to COVID-19***
2. **Annavajhala MK**, Shah J, Weidler J, Kister K, Demmer RT, Wadhwa S, Yin MT, Uhlemann A-C. Periodontal disease and the oral microbiome in antiretroviral-treated patients with HIV. ACTS 2020 ***Conference cancelled due to COVID-19***
3. **Annavajhala MK**, Gomez-Simmonds A, Macesic N, Sullivan SB, Khan SD, Giddins MJ, Stump S, Verna EC, Uhlemann A-C. Microbial signatures of colonization by multidrug-resistant organisms (MDRO) in liver transplant recipients. ASM Microbe 2019; San Francisco, CA.
4. Verna E, **Annavajhala MK**, Nenad M, Brown R, Sullivan S, Korakani G, Giddins M, Khan S, Gomez-Simmonds A, Uhlemann A-C. Intestinal Microbiome Diversity is Associated with Liver Disease Etiology and Predicts Post-Liver Transplant Mortality. ATC 2018; Seattle, WA.
5. Zhou MJ, Cohen ME, **Annavajhala MK**, Moscosco D, Brooks C, Whittier S, Chong DH, Uhlemann A-C, Abrams JA, Freedberg DE. Gastrointestinal Bacterial Pathogen Colonization and Risk for Subsequent Infection in the Intensive Care Unit. DDW 2018; Washington, D.C.
6. Verna EC, Macesic N, **Annavajhala MK**, Giddins MJ, Stump S, Brown RS, Gomez-Simmonds A, Uhlemann A-C. Dynamic adaptations of intestinal microbiota after liver transplantation. AASLD 2017; Washington, D.C.
7. **Annavajhala MK**, Kapoor V, Santo-Domingo J, Chandran K. Comammox functionality is ubiquitous in engineered biological wastewater treatment systems. WEFTEC 2017; Chicago, IL. * *Conference Featured Presentation/Speaker*
8. **Annavajhala MK**, Fanyin-Martin A, Taher E, Elk M, Kapoor V, Santo-Domingo J, Chandran K. Metagenomics of Anaerobic Food Waste Fermentation. WEFTEC 2017; Chicago, IL.
9. Park MR, **Annavajhala MK**, Park H, Chandran K. Nationwide survey of microbial structure, function and metabolic pathways driven by wastewater treatment plant operating conditions and designs revealed using metagenomic and metatranscriptomic approaches. WEFTEC 2017; Chicago, IL.

10. **Annavajhala MK**, Li Z, Chandran K. Metagenomics of a Mainstream Biofilm-Based Deammonification Process with and without Bioaugmentation from a Sidestream Deammonification System. AEESP Late-Breaking Session, WEFTEC 2016; New Orleans, LA.
11. Brotto AC, **Annavajhala MK**, Chandran K**.** Effect of Long-Term Anoxic-Aerobic Cycling on Nitrous Oxide Emissions through a Combined Metagenomics and Metatranscriptomics Approach. WEF/IWA Nutrient Removal & Recovery 2016; Denver, CO.

F. Poster Presentations

1. Gomez-Simmonds A, **Annavajhala MK**, McConville TH, Dietz DE, Shoucri SM, Laracy JC, Nelson B, Whittier S, Uhlemann A-C. Cluster of carbapenemase-producing Enterobacterales secondary infections during the COVID-19 crisis at a New York City hospital. IDWeek 2020
2. Rubin, LG, Beachy J, Uhlemann, A-C, **Annavajhala MK**, Balamohan A, Jendresky L. Prolonged Outbreak of Clonal, Mupirocin-resistant Methicillin-resistant Staphylococcus aureus (MRSA) in a Neonatal Intensive Care Unit (NICU): association with Personnel and Possible Environmental Reservoir, analyzed using Whole Genome Sequencing (WGS). PAS 2020.
3. Ahn D, Bhushan G, McConville TH, **Annavajhala MK**, Uhlemann A-C, Prince AS. Enhanced bioenergetics by a novel acyltransferase promotes persistence of carbapenem-resistant K. pneumoniae in the airway. AJRCCM 2020.
4. Wong T, Shi W, Urso A, **Annavajhala MK**, Uhlemann A-C, Prince AS. Carbapenemase-producing *Klebsiella pneumoniae* ST258 activates the T6SS in response to the host metabolite itaconate to promote bacterial adaptation to the lung. AJRCCM 2020.
5. Yoo K, **Annavajhala MK**, Kapoor V, Santo-Domingo J, Chandran, K. Mining antibiotic resistance genes and potential human pathogens in biological nitrogen removal processes nationwide using shot-gun metagenomic analysis. WEFTEC 2019; Chicago, IL.
6. **Annavajhala MK**, Gomez-Simmonds A, Macesic N, Sullivan SB, Kress A, Khan SD, Giddins MJ, Stump S, Verna EC, Uhlemann A-C. Drug Class-Specific Relationship between Antibiotic Exposure and the Gut Microbiota in a High-Risk Liver Transplant Cohort. ASM Microbe 2019; San Francisco, CA. ***** *Selected for Outstanding Abstract Award and Rapid-Fire Poster Talk*
7. Rojas R, Macesic N, Tolari G, Guzman A, **Annavajhala MK**, Uhlemann A-C. Emergence of diverse carbapenem-resistant Enterobacteriaceae (CRE) in the Dominican Republic. ID Week 2018; San Francisco, CA.
8. **Annavajhala MK**, Saidu R, Tergas A, Kuhn L, Denny L, Uhlemann AC. Distinct cervical microbial diversity and community structure by human papilloma-virus and cervical disease status in HIV-positive women in South Africa. Microbiome in HIV 2018; Rockville, MD.
9. **Annavajhala MK**, Geng W, Hill-Ricciuti A, Ferguson S, Stump S, Giddins MJ, Messina M, Zachariah P, Green D, Whittier S, Saiman L, Uhlemann AC. Hybrid Sequencing and Assembly Reveals Genomic Diversity of Methicillin-susceptible Staphylococcus aureus (MSSA) from a Neonatal Intensive Care Unit (NICU) Surveillance Effort. ASM Rapid Applied Microbial Next Generation Sequencing and Bioinformatic Pipelines 2018; Tysons, VA.
10. May M, **Annavajhala MK**, Compres G, Freedberg DE, Graham R, Uhlemann AC, Abrams JA. A Randomized Controlled Trial to Assess the Effects of an Antimicrobial Mouthwash on the Oral and Esophageal Microbiome. DDW 2018; Washington, DC.

G. Thesis

1. **Annavajhala MK**. Meta-omics-derived structure, function, and activity of mixed microbial communities driving biological nutrient removal and recovery. Columbia University, New York, NY, 2017.

Invited Presentations

1. "Activism in the STEM Workplace." BioMediGirls Annual Advocacy Summit 2020; online.
2. "The Human Microbiome: Health, Illness, and Prevention." Bloomingdale Aging in Place, 2019; New York, NY.
3. "Genomics of methicillin-susceptible *Staphylococcus aureus* (MSSA) from a neonatal intensive care unit (NICU)." Pediatric Infectious Diseases Division Conference Rounds, Columbia University Medical Center, 2019; New York, NY.
4. "Microbiome 101." Microbiome Working Group Seminar Series, Columbia University Medical Center, 2017; New York, NY.
5. **"**Using Molecular Techniques and Next-Generation Sequencing to Understand and Optimize Wastewater Treatment Processes." Hot Topics in Water and Wastewater, NJAES Office of Continuing Professional Education, Rutgers University, 2015; Belvedere, NJ.
6. **"**Meta-Omics of the Engineered Water Cycle." Ion Torrent World Tour, 2015; New York, NY.

Trainings and Workshops

Exposome Bootcamp, Columbia University Mailman School of Public Health, July 2020

Machine Learning Bootcamp, Columbia University Mailman School of Public Health, June 2019

Introduction to Python, Foundations for Research Computing, Columbia University, August 2019