Jyot Antani, PhD

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Expertise: Microscopy, Single Particle Tracking, Microbial Biophysics, Phage-Bacteria Interactions, Phage Therapy, Phage Technology

Experience & Education

Jun 2021- *Now*	Postdoctoral Research Associate, Yale University (US) Center for Phage Biology & Therapy, Yale University Quantitative Biology Institute, Yale University Paul Turner Lab, Department of Ecology and Evolutionary Biology In collaboration with Thierry Emonet Lab, Molecular, Cellular, and Developmental Biology
Aug 2016- May 2021	PhD, Pushkar Lele Lab, Department of Chemical Engineering, Texas A&M University (US) Dissertation: Sensory Functions of the Bacterial Flagellar Motor
Jul 2012- May 2016	Bachelor of Technology with Honours in Chemical Engineering Indian Institute of Technology Bombay (IIT Bombay), Mumbai (India)

Advanced Microscopy Training: Optical Microscopy & Imaging in the Biomedical Sciences (OMIBS)
Marine Biological Laboratory, Woods Hole Massachusetts (US)

Aug 2023	Research Facilitator (Teaching Assistant)
Aug 2022	Course Participant

- Basic principles of microscopy from academic and industrial microscope builders and inventors including...

Light path, image formation, and detection	Photophysics of fluorescence, dyes, and fluorescent proteins
Dynamic Imaging Techniques (FRET, FLIM, FCS)	Point Spread Functions, Deconvolution,& Confocal Microscopy
Multiphoton & Light Sheet Microscopy; Adaptive Optics	Super-resolution Techniques: STED, STORM, SIM

- Hands-on practice with over 40 microscopes including the following modalities...

Phase-contrast Microscopy	Differential Interference Contrast (DIC)	Polarized Light Microscopy
Epifluorescence	Forster Resonance Energy Transfer	Fluorescence Lifetime Imaging
Confocal Microscopy	Total Internal Reflection Fluorescence	Deconvolution
Multiphoton Microscopy	Light Sheet Microscopy	Super-resolution: STED, STORM, SIM

Academic Positions

2024-2026 | Early Career Editorial Board Member, *The FASEB Journal*

Publications

* indicates equal contribution

Google Scholar Link

Antani JD, Ward T, Emonet T, Turner PE. High-throughput quantification of virus particle attachment to host bacterial cells. *Under Review at Proc Natl Assoc Sci (PNAS) USA*.

Oromí-Bosch A*, Antani JD*, Turner PE (2023) Developing Phage Therapy That Overcomes the Evolution of Bacterial Resistance. *Annu Rev Virology*. doi: 10.1146/annurev-virology-012423-110530

Antani JD, Gupta R, Lee AH, Rhee KY, Manson MD, Lele PP (2021) Mechanosensitive recruitment of stator units promotes binding of the response regulator CheY-P to the flagellar motor. *Nature Communications*. doi: 10.1038/s41467-021-25774-2

Antani JD, Sumali AX, Lele TP, Lele PP (2021) Asymmetric random walks reveal that the chemotaxis network modulates flagellar rotational bias in *Helicobacter pylori*. *eLife*. doi:10.7554/eLife.63936

This work helped secure an R01 research grant totaling over $1.3 million from the National Institute of General Medical Sciences, National Institute of Health. https://www.eurekalert.org/news-releases/945164

Katiyar A*, Antani JD*, McKee BP, Gupta R, Lele PP, Lele TP (2021) A method for direct imaging of x-z cross-sections of fluorescent samples. *Journal of Microscopy*. doi:10.1111/jmi.12965

Wong GCL, Antani JD, et al. (2021) Roadmap on emerging concepts in the physical biology of bacterial biofilms: from surface sensing to community formation. *Physical Biology*. doi:10.1088/1478-3975/abdc0e

Antani JD, Shaji A, Gupta R, Lele PP (2024) Reassessing the Standard Chemotaxis Framework for Understanding Biased Migration in *Helicobacter pylori*. *Annu Rev Chem Biomol Eng*. doi:10.1146/annurev-chembioeng-100722-114625

Ford KM, Antani JD, Nagarajan A, Johnson MM, Lele PP (2018) Switching and torque generation in swarming cells of *E. coli. Frontiers in Microbiology*, 9, 2197. doi:10.3389/fmicb.2018.02197

Katiyar A, Zhang J, Antani JD, Yu Y, Lele PP, Reinhart-King CA, Sniadecki NJ, Roux KJ, Dickinson RB, Lele TP (2022) The Nucleus Bypasses Obstacles by Deforming Like a Drop with Surface Tension Mediated by Lamin A/C. *Advanced Science*. doi: 10.1002/advs.202201248

Publications in preparation

Antani JD, Theroux A, Emonet T, Turner PE. Evolutionary consequences of bacterial resistance to a flagellotropic phage. Media mention of this work in the ASM Microcosm magazine (link)

Antani JD, Turner PE. Infectivity of a single phage: a perspective.

Nassereddine A, Antani JD, et al., Horsley V. Mechanical regulation of trans-nucleus protein transport.

Invited Talks/Seminars

Nov 2023	Microbial Tresure Hunt: How Bacteria and Viruses Find their Haven. Departmental Seminar, Chemical Engineering, Indian Institute of Technology Bombay (India)
Oct 2021	Force-regulation of CheY-P-binding to the bacterial flagellar motor. Howard Berg Lab, Harvard University (US)

Peer Reviews (Independent)

Publons / WebOfScience Link

Microbiology Spectrum (19)
Archives of Microbiology (11)
Frontiers in Microbiology (2)
European Biophysics Journal (1)
Frontiers in Physiology (1)
Physical Biology (4)
PeerJ (10)
Biosystems (2)
PLoS One (2)
Cancer Reports (1)
Applied & Environmental Microbiology (5)
STAR Protocols (4)
Frontiers in Toxicology (1)
APL Bioengineering (3)

Honors & Awards

2023	Top Reviewer 2023, *Microbiology Spectrum*– an American Society for Microbiology (ASM) Journal
2023	Best Poster Presentation Award, Yale Postdoctoral Association Annual Symposium 2023, Yale University
2022	BioImaging North America (BINA) Professional Development Award - Chan Zuckerberg Initiative
2022	Histochemical Society (HCS) Travel Award
2020	CIRTL Associate Certificate, Center for the Integration of Research, Teaching, and Learning
2015	Best Poster Award, *AMAT* seminar, IIT Bombay
2015	Undergraduate Research Award URA01, IIT Bombay
2012	All India Rank 1427 in Joint Entrance Examination for engineering, among 479,651 participants
2008	National Talent Search Scholarship, NCERT, India

Technical Skills

Perfusion & Thermal Control Experiments
Bacteria & Phage Culturing, Cloning
Genome Analysis/Bioinformatics
Prototyping & 3D-printing
Microfluidics Experiments
Assay Development
Optical Microscopy: advanced expertise
Image Analysis Automation
Single Particle Tracking

Computational Skills

Image Processing & Analysis:	MATLAB, Python, ImageJ – {Highlights: particle-tracking; segmentation}
Genetic Analysis:	Molecular Biology {SnapGene, Benchling}, Bioinformatics
Design & Development:	SolidWorks, AutoCAD, LabVIEW,
Simulation Packages:	ANSYS Fluent, Aspen Plus, OpenFOAM, COMSOL, CHARMM, VMD
Programming:	MATLAB, Python, C, C++, Fortran, HTML

Special mention: **Yale Biotech Club Datathon 2022**

- Performed analysis on single-cell RNAseq data from patients of Colorectal Cancer and Inflammatory Bowel Disease
- Used scanpy to study the variability in expression of various genes and identify marker genes associated with the two diseases

Conference Presentations

Antani JD, Ward TJ, Emonet T, Turner PE. Quantitative biology of bacterial virus attachment to host surfaces.

Mar 2024	American Physical Society March Meeting 2024, Minneapolis (US)
Jan 2024	Bacteria versus Phage: the Main Event, Princeton Center for Theoretical Science Workshop, Princeton University (US)
May 2023	Yale Postdoctoral Association Symposium, Yale University, New Haven (US)
Sep 2022	Annual Microbiology Retreat, Yale University, New Haven (US)
Jun 2022	*Microbe*- Annual meeting of the American Society for Microbiology, Washington, D.C. (US)
May 2022	Yale Postdoctoral Association Symposium, Yale University, New Haven (US)

Antani JD,Theroux A, Emonet T, Turner PE. Bacterial Evolution Of Resistance To A Flagellotropic Phage.

Sep 2023	Annual Microbiology Retreat, Yale University, New Haven (US)
Jun 2023	*Microbe*- Annual meeting of the American Socierty for Microbiology, Houston (US)

Antani JD, Lele PP. Modulation of chemotactic signaling in bacteria by mechanical forces.

Mar 2019	ChEGSA Annual Symposium, Texas A&M University, College Station (US)
Oct 2018	American Institue of Chemical Engineers (AIChE) Annual Meeting, Pittsburgh (US)
Dec 2017	Texas Branch of American Society for Microbiology, 2017 Fall Meeting, College Station (US).

Antani JD, Lele PP. Asymmetric Swimming and Chemotaxis in *Helicobacter pylori*.

Jan 2021	Bacterial Locomotion And Signal Transduction (BLAST) XVI Meeting, Zoom (online)
Feb 2020	Biophysical Society (BPS) Annual Meeting, San Diego (US).
Jan 2019	Bacterial Locomotion And Signal Transduction (BLAST) XV Meeting, New Orleans (US)

Antani JD, Venkatesh KV. Analysis of Glucose Homeostasis in Humans.

Nov 2015	Futuristic Approach for Alternatives to Animal Testing CEFIPRA seminar, Mumbai (India)

Current and Doctoral Research

May 2021-Now — Postdoctoral Research: **Host-virus Interaction Biophysics in Microbes**

Evolution of target search by bacteriophages on host bacterial surfaces

- Established a protocol for labeling phages (the viruses of bacteria) with a lysine-binding fluorescent dye
- Visualizing labeled phage (bacterial virus) particles attaching to host cells, through epifluorescence and HILO microscopy
- Set up MATLAB-based statistical analysis of single phage trajectories to quantify attachment dynamics
- Employing Bayesian inference to estimate the diffusive states of phage particles from single trajectories
- Developing a quick high-throughput assay to quantify phage adsorption, applicable for emergency phage therapy
- Comparing the attachment dynamics of ancestral and coevolved phage-host pairs

Evolution of resistance in E. coli against a flagellotropic phage

- Evolved mutants resistant against phage χ, a virus that uses rotating bacterial flagella as receptors
- Trained an undergraduate to carry out the experimental evolution protocol, mentored them in writing a successful fellowship application about this project
- Characterizing the genotype and phenotype of the evolved mutants to determine the evolutionary consequences

Grant-Writing

- Wrote several fellowship and grant applications to fund the original research projects

Aug 2016-May 2021 — Doctoral Thesis: Sensory Functions of the Bacterial Flagellar Motor

Molecular mechanisms of host substrate sensing by bacterial flagellar motors

- Determined the effect of mechanical forces on chemotactic output of the bacterial flagellar motor, with phase microscopy, optical tweezers, and TIRF imaging
- Developed a biophysical model for the regulation of allosteric interactions by mechanical force

Motility, chemotaxis, and random spread of Helicobacter pylori, the carcinogenic pathogen

- Devised a microscopy-based technique to experimentally determine the chemotactic activity of *H. pylori*
- Studied the biophysical principles governing chemotactic migration by this bacterial species which employs run-reversal motility – different from the traditionally studied *E. coli*

Design and development of experimental and analytical framework

- Designed 3D-printed imaging chambers for requirements in microscopy experiments, e.g., perfusion, imaging side-views
- Wrote MATLAB-based image analysis codes for tracking motile bacteria, mammalian cell-nuclei, and fluorophores

Additional Research Experience

Jul 2015-Feb 2016 | **Machine Learning Classification of Glucose Homeostasis in Diabetic and Healthy Individuals**
Venkatesh Lab, Chemical Engineering, IIT Bombay

- Formulated a Hill function-based empirical biochemical model of body glucose concentration following a fixed food-intake, obtained least-squares fits to data acquired from 150+ individuals
- Constructed a classification tree based on fit-parameters using machine learning in MATLAB; established a statistical grouping among Diabetic and Healthy individuals

May-Jul 2015 | **A Novel Protocol for Coating Lipid Bilayers onto Silver Nanocubes**
Hung-Jen Wu Lab, Texas A&M University

- Established a tip-sonication protocol to make small unilamellar vesicles of lipids
- Coated the unilamellar vesicles as supported lipid bilayers onto Silver nanocubes
- Employed a Localized Surface Plasmon Resonance-based nanocube sensor to monitor protein binding on lipid bilayers
- Analyzed binding kinetics of GM1 ganglioside with Cholera Toxin Subunit B

May 2014-Apr 2015 | **Simulation-Design of a Chemical Vapor Deposition Reactor**
Mahesh Tirumkudulu Lab, IIT Bombay

- Simulated fluid flow around a disk, successfully obtained the pressure coefficients observed experimentally in literature.
- Proposed an unconventional design for uniform coating of parylene polymer onto silicon micro-wafers in a micro-scale Chemical Vapor Deposition reactor.
- Modeled Parylene flow using ANSYS Fluent, enhanced the proposed design.

Jun 2013 | **Process Improvement in Jaggery-manufacturing Technology**
Sanjay Mahajani Lab, IIT Bombay

- Studied units for continuous production and recuperation of Jaggery, the traditional non-centrifugal cane sugar
- Analyzed Jaggery samples for acidity, moisture content, water activity, density, sugar content, & structure (XRD, ESEM)

Key Course Projects

Determining Diffusion Coefficient of Microparticles using Particle-Tracking Algorithms *Course: Colloidal Applications and Biomolecular Interactions in Life Science (Spring 2018)*

- Employed particle-tracking algorithms in MATLAB to track the Brownian diffusion of submicron-sized particles recorded using phase-contrast microscopy
- Determined the diffusion coefficient of particles by calculating the average mean-squared displacement of an ensemble

Proposal: Evolution of Bacterial Flagellum *Course: Evolutionary Bioinformatics (Spring 2017)*

- Proposed a study involving the comparison of flagellar genome across multiple bacterial species which has potential to aid in obstruction of pathogenic motility
- Carried out BLAST alignment analysis for nucleotide and protein sequences of flagellin (flagellar filament) gene as preliminary results

Review: How Deep a Cell Can Sense *Course: Cell Mechanics (Spring 2016)*

- Carried out a literature survey and reported theoretical, in-vitro, and in-silico studies on quantified investigations about the range of mechanical signaling

On-line Estimation of Concentrations in a Bio-Reactor *Course: State Estimation (Fall 2015)*

- Generated true states from a model based on substrate uptake, phosphorus repression, and effect of seed culture on glyco-peptide antibiotic production
- Implemented the Simple, Extended, and Unscented versions of the Kalman Filter to estimate the concentrations

Teaching & Mentoring Experience

Fall 2019 | A hands-on workshop for image processing and single particle tracking in MATLAB
Pushkar Lele Lab, Texas A&M University

Undergraduate students mentored

Sep 2022-Nov 2023 | Timothy Ward, Undergraduate Researcher, Yale University
Attachment of bacteriophages to bacterial cells: the classical adsorption assays
Best Poster Award winner at Yale Undergraduate Research Symposium, March, 2023

Oct 2021- | Austin Theroux, STARS II Science & Quantitative Reasoning Education Scholar, Yale University

Oct 2022	Evolution of motile bacteria against a bacteriophage that attaches through the flagellum Presented a poster about this work at *Microbe* ASM meeting at Washington DC in June, 2022
Dec 2019- Jan 2021	Anita Sumali, Gathright Scholar, Biomedical Engineering, Texas A&M University MATLAB-based quantitative analysis of the run-reversal motility of *H. pylori*; co-author on Antani et al., eLife, 2021 Currently enrolled in EnMed (MEng/MD dual degree program) at Texas Medical Center, Houston (US)
Apr 2017- Apr 2018	AggiE_Challenge – Undergraduate Mentoring, Texas A&M University Graduate-mentor to a multidisciplinary team of eight undergraduate students employing 3D-printing technology to design scaled-up bacterial models, in order to study the hydrodynamic effects of cell morphology on motility

Teaching Assistant at Texas A&M Chemical Engineering

Spring 2019	Heat Transfer Operations
Spring 2017	Bioprocess Engineering
Fall 2016	Bioprocess Engineering

Teaching, Mentoring, & Management Training

Sep 2021- Dec 2021	Auburn University's Preparing Future Faculty Workshop Interactive workshops consisting panel discussions from faculty and university administrators
Sep 2021	Fundamentals of Inclusive Teaching *Poorvu Center: Graduate and Postdoctoral Teaching Development, Yale University* A 4-part workshop on creating a respectful, supportive, equitable, and transparent classroom environment
Aug 2018- Dec 2019	Academy for Future Faculty (AFF), Center for Teaching Excellence, Texas A&M University *Faculty Mentor: Dr. Micah Green, Texas A&M University* A program designed for training graduate students as future faculty members, featuring weekly seminars and workshops, and anchored by faculty mentorship
Jul- Aug 2019	An Introduction to Evidence-Based Undergraduate STEM Teaching *Muti-university Massive Open Online Course from the NSF-founded CIRTL network* Eight-week online course on edX.org catering introduction to effective teaching strategies and the research that supports them. Attended local learning community meetings for the course at Texas A&M University.
Oct 2019	Improving Research Mentoring Relationships – Introduction to Effective Mentorship *Center for the Improvement of Mentored Experiences in Research (CIMER)* 1-day workshop at Texas A&M University, conducted by CIMER from University of Wisconsin-Madison

Leadership & Management Experience

Jan 2022- Jun 2024	Communications Committee Manager and Coordinator, Yale Postdoctoral Association (YPA) • Leading a team of volunteers to manage website, social media, and weekly + monthly newsletters for the YPA
Jun 2021	People Management Skills – Course, Chartered Institute of Personnel and Development, UK
Oct 2018- Aug 2020	Secretary (2018-19) & Chair (2019-20), Chemical Engineering Graduate Student Advisory Council *Artie McFerrin Department of Chemical Engineering, Texas A&M University* • Designed the council by-laws as a founding member • Set up channels of communication through surveys and anonymous feedback mechanisms, between grad students and administration in the department • Addressed grad student welfare issues including salary, benefits, mental well-being, work-life balance, student-advisor relationships, facilities, career events, and social events
Apr 2014- Mar 2015	Competitions Manager, AZeotropy 2015 *IIT Bombay's Intercollegiate Chemical Engineering Symposium* • Pioneered a new model-making competition *ChemETimer* based on time-precision • Designed a presentation-based competition *Swaasthya* on engineering-applications to healthcare • Designed *Cipher*, the online cryptic hunt which received a participation of 400+ • Actualized unconventional chemical engineering quizzing for *Chem-O-Philia*, national level quiz

Science Outreach Volunteering Experience

May 2024	Flipped Science Fair at Yale University Presented a poster about current research topic to middle school students in the New Haven County, Connecticut.
Mar 2023	Tiny World for Little Humans: Teaching Quantitative Microscopy to Underserved Youth

- Taught quantitative microscopy through the use of paper microscopes (foldscope.com) to middle school students at Fair Haven School, New Haven, Connecticut
- Outreach project funded by the MBL ROCS- Marine Biological Laboratory Regional Outreach and Communication in STEM

Feb 2022-Sep 2022 | Associate Writer & Editor, LabLeaks
A biweekly mailing list summarizing recent noteworthy scientific articles to the general audience.

Feb 2022 | Exploring Science for Middle School Students
Presented doctoral research topic to middle school children in the New Haven County, Connecticut

Jul 2020 | Coronasurveys: Monitoring the Incidence of COVID-19 via Open Surveys
Volunteered services as the primary translator of the survey to the Gujarati language.