Abhishek Shrivastava, PhD

Assistant Professor, Arizona State University

Biodesign Institute B330D, Tempe, AZ 85281.

Email: ashrivastava@asu.edu Lab website Link

APPOINTMENTS

Aug. 2019 - present	**Assistant Professor,** School of Life Sciences & the Biodesign Institute. Center for Fundamental and Applied Microbiomics. Center for Biological Physics. Affiliate: Center for Health Through Microbiomics and Center for Mechanisms of Evolution. Arizona State University, Tempe, AZ.
April 2025 - present	**Research Affiliate.** Dept. of Immunology, Mayo Clinic, Phoenix, AZ.
April 2017 - July 2019	**Visiting Scientist**. The Forsyth Institute, Cambridge, MA.
Aug. 2017 - July 2019	**Scientist**. The Rowland Institute at Harvard, Cambridge, MA.
April 2017 - July 2019	**NIH-NIDCR K99/R00 Fellow.** Recipient of *NIH K99/R00 Pathway to Independence Award*. Primary Advisor: Howard C. Berg, Harvard University. Co-Advisor: Floyd E. Dewhirst, The Forsyth Institute.

TRAINING AND EDUCATION

April 2013 - July 2017	**Postdoctoral Fellow.** Microbiology & Physics. Department of Molecular and Cellular Biology, Harvard University, Cambridge, MA. Primary Advisor: Howard C. Berg.
Oct. 2016 - Nov 2016	**Student.** Marine Biological Laboratory, Woods Hole, MA. Physical Biology of the Cell Course. Research Advisor: Jane Kondev.
May 2013 - Oct. 2013	**Research Fellow:** Medical College of Wisconsin, Milwaukee, WI.
Aug. 2008 - April 2013	**PhD:** Molecular Microbiology. Advisor**:** Mark J. McBride. University of Wisconsin-Milwaukee, WI. Recipient of *Ruth Walker award*.
July 2006 - May 2008	**MSc:** Department of Biochemistry. Maharaja Sayajirao University of Baroda, India. Recipient of *Junior Research Fellowship (JRF-NET),* Center of Scientific and Industrial Research *(CSIR), New Delhi, India*.
July 2003 - May 2006	**BSc:** Department of Biotechnology. Sardar Patel University, India. Graduated with distinction.

RESEARCH AREAS

My lab at ASU primarily studies the bacterial Type 9 secretion system (T9SS), a dual-function rotary nanomachine powering bacterial gliding motility and protein secretion in key microbiomes. Our research investigates: **(i)** molecular mechanisms controlling T9SS rotation and bacterial gliding, **(ii)** collective swarming behavior and its impact on the spatial structure of polymicrobial communities, and **(iii)** the roles of T9SS-secreted proteins in microbiome-host interactions and health.

While we are best known for our T9SS expertise, we also engage in diverse projects independent of T9SS, driven by collaborative opportunities and scientific curiosity. These include examining microbiota contributions to colorectal cancer, contributions of bacterial flagellar dynamics towards fitness, experimental evolution of gut microbes as probiotics that produce neuromodulatory compounds, spatial analysis of the sourdough microbiome, and development of a tool to create a 3D atlas of live gut microbiota.

RESEARCH SUPPORT / GRANTS

Total external award amount received at ASU: $ 4,944,496.00.

- Total 6 awards (4 awards as PI with 100% effort 2 awards as co-PI).

Total award amount applied at ASU: $ 23,497,391.00.

- Total amount of the grants that were submitted but not funded: $ 15,229,189.00.
- Total pending award amount: $ 3,323,706.00

Active grants.

1. **NIH-NIGMS (R35GM147131) Maximizing Investigators' Research Award (MIRA) Award period.** 2022-2027**. PI.** Abhishek Shrivastava, Arizona State University. **Effort. 100 % Award amount.** $ 1,962,500.00. **Title.** Mechanistic investigation of bacterial type 9 secretion system machinery and its involvement in gut metabolism and immunomodulation.
2. **NIH S10 Instrumentation Award. (2024-2025). PI.** Po-Lin Chiu. **Co-PI**: Dr. Shrivastava is one of the 17 listed major users/co-PIs that contributed to the writing of this proposal**. Title:** Electron Energy Filtering System for Cryo-EM Imaging**. Summary:** This is an award to update the cryo-EM at ASU. **Award amount:** $1,999,997.00

Completed grants.

3. **Scialog Microbiome, Neurobiology, and Diseases Award. Award period (SA-MND-2023-027a).** Sponsored by Research Corporation for Scientific Advancement (RCSA), Paul Allen Foundation, Cottrell foundation.
   Award period – July 2023 - Aug. 2024. PI. Abhishek Shrivastava, Arizona State University. **Effort. 100% Award amount.** $ 55,000.00**. Title:** Could feces be used as a natural time capsule for mapping of signal-generating hubs within the gut?
4. **Edson Initiative for Dementia Care and Solutions (co-PI). Award Period – Aug. 2023-June 2024.** Sponsored by Edson New Idea seed fund. PI - Dhara Shah, ASU (Effort – 70%). **co-PI – Abhishek Shrivastava. Effort. 30% Total Award amount.** $ 125,000.00. **Title.** Laboratory evolution of a gut microbe from a GABA producer to a Taurine producer and enhancement of its capability to cure dementia.
5. **Scialog Microbiome, Neurobiology, and Diseases Award (Award #27924). Award period - 2021-2022.** Sponsored by Research Corporation for Scientific Advancement (RCSA), Paul Allen Foundation, Cottrell foundation. **PI. Ab**hishek Shrivastava, Arizona State University. **Effort. 100% Award amount.** $ 55,000.00. **Title:** Do bacterial outer membrane vesicles (OMVs) act as modulators of microbiota-brain communication involved in the development of neurological diseases?
6. **NIH-NIDCR R00 Award**. **Award period.** 2020-2024**. PI.** Abhishek Shrivastava, Arizona State University. **Effort. 100 % Award amount.** $ 746,999.00. **Title:** Dynamics of the bacterial type IX secretion system and its effect on subgingival biofilm formation by bacteria of the human oral microbiome.

Pending grants.

7. **NSF General Award**. 2025 -2028. PI - Shrivastava (ASU), co-PI - Kaplan (University of Chicago). **Effort** 60%. **Award amount.** $ 1,823,706.00. **Title:** Collaborative Research: Structural and functional mechanisms of a molecular conveyor belt machinery that drives bacterial gliding motility**.**
8. **Human Frontier Science Program (HFSP) Research Grant Program.** Letter of intent submitted. Lead PI: Abhishek Shrivastava (ASU), co-PI's: Silvia Vignolini (Max Plack institute if Colloids and Interfaces, Germany and University of Cambridge, UK), Gaurav Sharma (Indian Institute of Technology (IIT) Hyderabad, India), Gil Ariel, Bar-Ilan University, Israel. Award amount. $ 1,500,000.00. Title: Light, color, action: motile aggregates of iridescent bacteria shaping structural color and ecology.

Submitted but not funded.

1. Department of Energy (2024). **PI:** Shepherd (ASU), Shrivastava (ASU), Wadhwa (ASU) **Effort:** 33%. **Award amount:** $ 2,269,938.00. **Title:** Multi-modal optical imaging of molecular signaling and individual microbe behavior within dynamic microbial communities.
2. NIH-NIDCR R01 award (2022). **PI.** Shrivastava. **Effort.** 100%. **Award amount.** $ 1,927,252. **Title.** Investigating the role of bacterial type 9 secretion system in shaping the spatial structure of the human oral microbiota.
3. Howard Hughes Medical Institute Freeman Hrabowski Scholars Program. (2023-2033). **PI.** Shrivastava. **Effort. 100%. Award amount.** $ 2,000,000.00 and up to $ 8.5 million potential support per scholar.

   Title. Investigation of a versatile microbial machinery and its role in gut metabolism and immunomodulation.
4. NIH Common fund Directors New Innovators Award – DP2 (2021). **PI.** Shrivastava. **Effort.** 100%. **Award amount.** $ 2,355,000. **Title.** Developing a tool to locate and tune signal generating hubs within the microbiota.
5. NIH-NIGMS R35 MIRA (2021). **PI.** Shrivastava. **Effort.** 100%. **Award amount.** $ 1,962,500.00. **Title.** The mechanism via which a mechanosensitive molecular machinery drives a conveyor belt on the bacterial cell-surface.
6. The Arnold and Mabel Beckman Foundation Young Investigator Award (semi-finalist, 2021). **PI.** Shrivastava. **Effort.** 100%. **Award amount.** $ 600,000.00. **Title.** Developing a tool to map signal generating hubs within the microbiome.
7. Gordon and Betty Moore Foundation Innovator Award. (2020). **PI.** Shrivastava. **Effort.** 100%. **Award amount.** $ 675,000.00. **Title.** Controlling bacterial colonization via a mechanosensitive molecular motor
8. Gordon and Betty Moore Foundation Innovator Award. (2019). **PI.** Shrivastava. **Effort.** 100%. **Award amount.** $ 675,000.00. **Title.** Computer vision driven assembly and swarming of beneficial microbes.
9. Flinn Foundation Seed grant. (2023-2024). **PI.** Shrivastava (ASU). **Effort** 100 %. **Award amount.** $ 100,000.00. **Title.** Phage therapy 2.0: Bacteria with Backpacks Drill Tunnels to Clear Biofilms.

HONORS AND AWARDS

1. **2021**. Semi-finalist for the Arnold and Mabel Beckman Foundation Young Investigator Award.
2. **2020.** Selected as a Scialog Fellow by Research Corporation for Scientific Advancement, Paul G. Allen Frontiers Group, and Fredrick Gardner Cottrell Foundation.

3. **2016.** Marine Biological Laboratories Scholarship**:** MBL, Woods Hole, MA.
4. **2016**. Travel Award**:** Annual Biomedical Research Conference for Minority Students, Tampa, FL.
5. **2014.** Postdoctoral Fellow Best Poster Award: MCB Retreat, Harvard University, Cambridge, MA.
6. **2012.** Ruth Walker Grant in Aid: University of Wisconsin-Milwaukee.
7. **2010.** Ruth Walker Grant in Aid: University of Wisconsin-Milwaukee.
8. **2008-2012.** Chancellors Graduate Award**:** University of Wisconsin-Milwaukee.
9. **2012.** Graduate School Travel Award**:** University of Wisconsin-Milwaukee.
10. **2010.** Graduate School Travel Award**:** University of Wisconsin-Milwaukee.
11. **2010.** Department of Bio Science Travel Award**:** University of Wisconsin-Milwaukee.
12. **2008.** Junior Research Fellowship (JRF-NET): Council of Scientific and Industrial Research (CSIR), New Delhi, India.

PUBLICATIONS

Significance of author order. For research articles, first authorships indicate the scientist that is primarily responsible for generating and analyzing data and writing the first draft. For review articles, first authorships indicate the individual that is primarily responsible for envisioning the scope and thesis of the manuscript while also being the primary writer. Corresponding authors in both cases usually represent the senior author to which correspondence should be addressed. Corresponding authors are responsible for the research design and the final version of the manuscript. While corresponding authors are usually at the end of the author list, sometimes authors can be first and corresponding. In addition, co-first and co-corresponding authorships are being more frequently assigned to individuals that contribute equally to these roles. Corresponding authorships are underlined. Equal contributions for first authorships are marked with a star (*). Middle authors are usually in order of their role in contributing to experimental design, data generation and analysis, intellectual input, and/or writing parts of the manuscript.

Research publications (published or under review) from ASU = 10. Including 8 published and 2 under review (1 under advanced 2nd round review). 9 of these lists a graduate student or postdoctoral fellow from my lab as first author and me as a corresponding or co-corresponding author. ***Software Development***: 3 open-source software tools developed and released by my lab. ***Manuscripts in preparation***: 4, with submission targeted by early fall of 2025.

Total published/accepted/under review articles = 20 (10 ASU): 8 as corresponding author, 3 as co-corresponding author, 8 as first author. ***Total products*** = 23 (20 published/accepted/under review articles) + 3 software. *Citations* = 749. *h-index* = 12. Citations and author metrics are from *Google Scholar*. *Trainees I mentored*: undergraduate researchers (u), graduate students - either fully committed or undergoing lab rotations (g) and postdoctoral fellows (p).

Publications from ASU.

23. Zdimal A.(p), Collins R.(u), Liu W.(g), and **Shrivastava A**. Swarming bacteria exhibit developmental phase transitions to establish scattered colonies in new regions. ***ISME Journal***, 2025. *IF = 10.8*. *Link*
    Role. PI and corresponding author directed experimentation, data analysis, and writing.
22. Dadi P.(g), Pauling C.W., **Shrivastava A**., Shah D.D. Synthesis of versatile neuromodulatory molecules by a gut microbial glutamate decarboxylase. ***iScience***, 2025, *IF = 4.6*. *Link*.
    Role. Contributor – directed simulations, interpretation, and data analysis.
21. Sen S.(g), Vairagare I.(g), Gosai J.(p), **Shrivastava A.** RABiTPy: an open-source Python software for rapid, AI-powered bacterial tracking and analysis. ***BMC Bioinformatics***. 2025, in press. *IF = 2.9*.
    Role. PI and corresponding author directed data analysis, interpretation, and writing.
20. Rocha ST.(g), Shah D.D. and **Shrivastava A**. Ecological, beneficial, and pathogenic functions of the Type 9 Secretion System. ***Microbial Biotechnology***, 2024, *IF = 4.8. Link*
    Role. PI and corresponding author directed conceptualization, interpretation, and writing.
19. Rocha ST.(g), Shah D.D., Zhu Q., and **Shrivastava A**. Prevalence of motility related genes in the human oral microbiome. ***Microbiology Spectrum***. 2024, *IF = 3.7. Link*
    Role. PI and corresponding author directed data analysis, interpretation, and writing.
18. Ratheesh N.K., Zdimal A.M.(p), Calderon C.A., and **Shrivastava A.** Bacterial swarm-mediated phage transportation disrupts a biofilm inherently protected from phage penetration. ***Microbiology Spectrum***. 2023.*IF = 3.7*. *Link*
    Role. PI and corresponding author directed experimentation, data analysis, and writing.
17. Trivedi A.(p), Gosai J.(p), Nakane D., **Shrivastava A**. Design principles of the rotary type 9 secretion system. ***Frontiers in Microbiology.*** 2022, *IF = 4*. *Link*
    Role. PI and corresponding author directed conceptualization, interpretation, and writing.
16. **Shrivastava A****. and Berg H. C.** A molecular rack and pinion actuates a cell-surface adhesin and enables bacterial gliding motility. ***Science Advances, 2020,*** 6 (10) eaay6616. ** Co-corresponding Authors. 2020, *IF = 13.6*. *Link*
    Role. Co-corresponding author conducted experimentation, data analysis, and writing.

Manuscripts under review.

15. Trivedi A.(p), Miratsky J.A.(g), Henderson E.C.(g), Singharoy A., and **Shrivastava A.** A membrane-associated conveyor belt controls the rotational direction of the bacterial type 9 secretion system. *Under advanced 2nd round review at **mBio.** IF = 5.1*. *bioRxiv Link*
    Role. PI and corresponding author directed experimentation, data analysis, and writing.

14. Sen S. (g), Henderson E.C. (g), Garcia-Pichel F., Kaplan M., and **Shrivastava A**. Diverse molecular motors converge to a common physical mechanism of microbial gliding motility. Under review at ***Journal of Bacteriology***. *IF = 2.7*.
    Role. PI and corresponding author directed conceptualization, interpretation, and writing.

Open-source software developed after joining ASU.

13. **RABiTPy (Python).** Released in 2025.
    Pypi page: https://pypi.org/project/RABiTPy/1.1.0/
    GitHub: https://github.com/indraneel207/RABiTPy
    Description: RABiTPy is a Python package for bacterial tracking that combines traditional and AI-based segmentation in a user-friendly Jupyter Notebook interface. It supports multiple image and video formats, handles large datasets efficiently, and runs on GPU, CPU, or cloud platforms.
    Role. PI and corresponding author directed software development and analysis.
12. **CellSize (Python).** Released in 2025. GitHub: https://github.com/strocha1/CellSize
    Description: CellSize is a Python tool to read, filter, label, and measure bacterial cells utilizing microscopic images. It allows a user to perform batch-processing of thousands of images while quickly measuring and plotting important physical attributes of a cell.
    Role. PI and corresponding author directed software development and analysis.
11. **HOMDscrape (Python).** Released in 2023.
    GitHub: https://github.com/strocha1/HOMDscrape
    Description: HOMDscrape is a Python tool written in the Jupyter Notebook interface to automate interaction and data extraction from the Human Oral Microbiome Database (eHOMD) webserver using an open-source API and the HTML code from eHOMD. It automates the extraction of species names and amino acid sequences from BLAST results or XML files and converts them into FASTA format for phylogenetic or sequence alignment analysis.
    Role. PI and corresponding author directed software development and analysis.

Manuscripts in Preparation with expected submission by early Fall of 2025.

1. Gosai J.(p), Arasteh A., Yang M. Zeytuni N., **Shrivastava A**. A unique sensory switch controlling zorbs - the motile biofilms of gliding bacteria.
   Role. PI and corresponding author directed experimentation, data analysis, and writing.
2. Sen S.* (g), Gosai J.* (p), Henderson E.C. (g), **Shrivastava A**. Gliding bacteria optimize their search efficiency by using surface adhesins to perform Lévy walks. *Equal contribution.
   Role. PI and corresponding author directed experimentation, data analysis, and writing.
3. Henderson E.C.(g), Trivedi A(p), **Shrivastava A**. A novel mechanosensory pathway regulates the adaptation of gliding bacteria to viscous load.

Role. PI and corresponding author directed experimentation, data analysis, and writing.

4. Trivedi A(p) and **Shrivastava A.** The molecular basis of polymerization of a bacterial cell-surface associated conveyor belt
   Role. PI and corresponding author directed experimentation, data analysis, and writing.

Publications prior to joining ASU.

10. **Shrivastava A**.**, Patel V., Tang Y., Yost S.C., Dewhirst F.E., and Berg H.C**. Cargo transport shapes the spatial organization of a microbial community. ***Proc Natl Acad Sci, 2018.*** August 115(34) 8633-8638. *Featured by NIH-NIDCR News & Harvard MCB News.* ** Corresponding Authors. IF = 12.78.
11. Johnston J.J.*, **Shrivastava A.*,** and McBride M.J. Untangling *Flavobacterium johnsoniae* gliding motility and protein secretion. ***Journal of Bacteriology***. ***2018*** January 200, no.2 e00362-17. * Equal Contribution. IF = 3.49.
8. **Shrivastava A.****, Roland T., Berg H. C.** The screw-like movement of a gliding bacterium is powered by spiral motion of a cell-surface adhesin. ***Biophysical Journal***. ***2016*** September, 111(5): 1008-13. *Featured on the Cover of Biophysical Journal. Featured by: Microbial Sciences Initiative (MSI) News.* ** Corresponding Authors. IF = 4.033.
7. Lele P. P., Roland T., **Shrivastava A.,** Chen Y and Berg H. C. The flagellar motor of *Caulobacter crescentus* generates more torque when a cell swims backwards. ***Nature Physics***. ***2016*** February; 12(2): 175-178. IF = 19.68.
6. **Shrivastava A**., and Berg H. C. Towards a model for *Flavobacterium* gliding. ***Current Opinions in Microbiology***. ***2015*** October, 28: 93-97. IF = 6.49.
5. Lele P. P., **Shrivastava A.,** Roland T and Berg H.C. Response thresholds in bacterial chemotaxis. ***Science Advances. 2015*** October; 1(9) e1500299. IF = 14.14.
4. **Shrivastava A.**, Lele P. P. and Berg H. C. A rotary motor drives *Flavobacterium* gliding. ***Current Biology***, ***2015*** February; 25(3): 338-341. *Featured by: Harvard Gazette.* IF = 10.83.
3. **Shrivastava A.,** Johnston J. J., van Baaren J. M. and McBride M. J. *Flavobacterium johnsoniae* GldK, GldL, GldM, and SprA are required for secretion of the cell-surface gliding motility adhesins SprB and RemA. ***Journal of Bacteriology, 2013*** July**;** 195(14): 3201-3212. 2013 IF = 3.4.
2. **Shrivastava A.**, Rhodes R. G., Nakane D, Pochiraju S and McBride M. J. *Flavobacterium johnsoniae* RemA is a mobile cell surface lectin involved in gliding. ***Journal of Bacteriology***, ***2012*** Jul; 194(14):3678-88. 2013 IF = 3.4.
1. Rhodes R.G., Samarasan M.N., **Shrivastava A.**, van Barren J. M., Pochiraju S, Bolampalli S and McBride M. J. *Flavobacterium johnsoniae gldN* and *gldO* are partially redundant genes required for gliding motility and surface localization of SprB. ***Journal of Bacteriology***, ***2010*** Mar; 192(5):1201-11. 2013 IF = 3.4.

RESEARCH IN THE MEDIA

1. Swarm Science: Oral bacteria move in waves to spread and survive. ASU News, 2025. https://news.asu.edu/20250324-science-and-technology-swarm-science-oral-bacteria-move-waves-spread-and-survive
2. Cruise control: gliding bacteria and their role in antimicrobial therapy. ASU News, 2023. https://news.asu.edu/20230717-cruise-control-gliding-bacteria-and-their-role-antimicrobial-therapy
3. Eight teams win funding in final year of Scialog: Microbiome, Neurobiology, and Disease. https://rescorp.org/news/2023/07/8-teams-win-funding-in-final-year-of-scialog-microbiome-neurobiology-and-disease
4. ASU's biodesign institute blazes new research trails. ASU News, 2023. https://news.asu.edu/20230216-asus-biodesign-institute-blazes-new-research-trails
5. ASU Professor wins Scialog award to fund research on development of neurological disorders. ASU News 2021. https://news.asu.edu/20210721-asu-professor-wins-scialog-award-fund-research-development-neurological-diseases
6. Scialog: Microbiome. Neurobiology and Disease Fellows named, 2020. https://rescorp.org/news/2020/03/scialog-microbiome-neurobiology-and-disease-fellows-named
7. Bacterial public transportation. Harvard MCB News, 2019. https://www.mcb.harvard.edu/department/news/bacterial-public-transportation-berg-lab/
8. Oral bacteria that glide throughout the mouth. Dentistry Today. 2019. https://www.dentistrytoday.com/oral-bacteria-glide-throughout-the-mouth/
9. Mystery motor. The Harvard Gazette, 2015. https://news.harvard.edu/gazette/story/2015/03/mystery-motor/

RESEARCH SEMINARS / TALKS (in-person, unless stated otherwise)

Total 44. Invited research talks outside ASU = 34. Invited research talks at ASU = 8.
Conference talks = 15. Seminars = 28.

Invited research seminars/conference talks outside ASU.

1. University of Chicago Medical School, Chicago, IL October 2024.
2. Loyola University Medical School, Center for Translational Research and Education Chicago, IL October 2024.
3. Biochemistry Seminar Series, University of Illinois at Urbana-Champaign, IL, October 2024.
4. International Union of Pure and Applied Biophysics (IUPAB) and Biophysics Society of Japan Annual Symposium – IUPAB 2024, Kyoto, Japan. June 2024.
5. Department of Microbiology and Immunology, Dartmouth University, NH. April 2023.
6. 17th Bacterial Locomotion and Sensory Transduction (BLAST) conference. January 2023, Charleston, SC.

7. Joint Biology and Neuroscience Colloquium, Brandeis University, Waltham MA. October 2022.
8. Gordon Research Conference on Sensory Transduction in Microorganisms. Ventura, CA. September 2022.
9. Department of Microbiology, the Ohio State University, February 2021. (virtual)
10. Introduction of the 'microbial interactions and communities' session of the 16th Bacterial Locomotion and Sensory Transduction (BLAST) conference. January 2021. (virtual)
11. Virtual Advanced Imaging Series, Biomedicine Discovery Institute, Monash University, Australia. December 2020. (virtual)
12. Parsons Microbial Systems Seminar, Department of Civil & Environmental Engineering, Massachusetts Institute of Technology (MIT), Cambridge, MA. April 2019.
13. Department of Basic Science and Craniofacial Biology, New York University, New York, NY. April 2019.
14. Division of Gastroenterology, Department of Medicine, University of Wisconsin Madison, WI. Feb. 2019.
15. Department of Microbiology, University of Chicago, IL. Feb. 2019.
16. Department of Biology, Virginia Tech University, Blacksburg, VA. Jan. 2019.
17. Department of Microbiology and Molecular Genetics, McGovern Medical School, University of Texas Health Science Center, Houston, TX. Dec. 2018.
18. Department of Biology, University of Delaware, Newark DE. Nov. 2018.
19. Microbial Science Initiative (*MSI*) chalk-talk, Harvard University, Cambridge, MA, Oct. 2018.
20. The Forsyth Institute, Cambridge, MA. July 2018.
21. General Session of the International Association of Dental Researchers (*IADR*), London, UK, July 2018. Session *Co-chair: Microbiome Session*.
22. Beneficial Microbes Meeting. Madison, WI, July 2018**.**
23. Boston Bacterial Meeting. Cambridge, MA, June 2018**.**
24. The Biophysical Society Annual Meeting. San Francisco, CA. February 2018.
25. Winter Quantitative Biology Conference, Maui, HI, February 2018.
26. Department of Molecular and Cellular Biology Retreat, Harvard University, Cambridge, MA. September 2017.
27. American Physical Society (*APS*) March Meeting. Baltimore, MD. March 2016.
28. Bacterial Locomotion and Sensory transduction (*BLAST*) meeting. New Orleans, LA. January 2017.
29. American Society for Microbiology (*ASM*) Microbe 2016. Boston, MA. June 2016.
30. National Center for Biological Sciences-Tata Institute of Fundamental Research (*NCBS-TIFR*), Bangalore, India. April 2016.
31. Flavobacterium meeting. Auburn, AL. October 2015.
32. Molecular Genetics of Bacteria and Phages meeting. Madison, WI. August 2015.

33. Boston Bacterial Meeting, Cambridge, MA. June 2015.
34. Bacterial Locomotion and Sensory transduction (*BLAST*) meeting. Tucson, AZ. January 2015.
35. Department of Biology, Indiana University, Bloomington, IN. November 2015.
36. The Forsyth Institute, Harvard School of Dental Medicine, Cambridge, MA. October 2015.
37. Milwaukee Microbiology Society Seminar Series, Great Lakes Water Institute. 2012.

Invited research talks at ASU.

38. Biodesign Townhall. September 2022.
39. Biodesign chalk talk. February 2022.
40. Center for Fundamental and Applied Microbiomics Retreat. December 2021
41. Physics Department Colloquium. September 2021 (virtual).
42. Center for Fundamental and Applied Microbiomics Summer Seminar Series. July 2020 (virtual).
43. Center for Biological Physics Seminar Series. January 2020 (virtual).
44. SOLS Friday Seminar Series. September 2019.

Selected Poster Presentations.

1. A bacterial cell-surface conveyor belt controls rotational direction of the type 9 secretion system. GRC Plant and Microbial Cytoskeleton, August 2022.
2. Cargo Transport Shapes the Spatial Organization of a Microbial Community. *ASM Biofilms Meeting*, Washington D.C. October 2018.
3. A Molecular Rack and Pinion Machinery Drives Surface Translocation. *Gordon Research Conference on Sensory Transduction in Microorganisms*. Ventura, CA. January 2018.
4. Bacterial Rock and Roll. *Gordon Research Conference on Sensory Transduction in Microorganisms*. Ventura, CA. January 2016.
5. Surface Navigation by Bacteria. *MCB Retreat*, Marine Biological Labs, Woods Hole, MA. September 2014. *Best poster award*.
6. Bacterial Surface Translocation and Type IX Secretion System. *Boston Bacterial Meeting*, Cambridge, MA. June 2014.
7. Bacterial Gliding Machinery. *Gordon Research Conference on Sensory Transduction in Microorganisms. Ventura*, CA. January 2014.
8. Identification of a Mobile Cell-surface Adhesin. *Gordon Research Conference on Bacterial Cell Surfaces*. Dover, VT. June 2012.
9. The Type IX Secretion System: A Novel Protein Translocation Machinery. *American Society for Microbiology (ASM) General meeting*, San Diego, CA. May 2010.

PROFESSIONAL SERVICES AND LEADERSHIP

OUTSIDE ASU

1. **2025.** Meeting review committee member at the bacterial locomotion and sensory transduction conference – BLAST XVIII, Cancun, Mexico.
2. **2023.** Organizing committee member of the bacterial locomotion and sensory transduction conference – BLAST XVII (Social media committee chair), Charleston, SC.
3. **2021.** Chair of the *Microbial traits: behavior, development, and pathogenesis* session of the virtual bacterial locomotion and sensory transduction conference – BLAST XVI.
4. **2018.** Chair of the *Oral Microbiome* session at the International Association of Dental Researchers (IADR) conference, London, UK.
5. **2016.** Served as a Judge to evaluate presentations by Undergraduate Students in the field of ***Molecular and Computational Biology*** at the Annual Biomedical Research Conference for Minority Students (ABRCMS), Tampa, FL.
6. **2015.** Co-chair, Career Development Committee, Faculty of Arts and Sciences Postdoctoral Association, Harvard University, Cambridge, MA.
7. **2013.** Coach for Cellular Dynamics seminar series at MCB Dept., Harvard University. Cambridge, MA.

Ad hoc reviewer after joining ASU

*Reviewer for academic journals (2019 - current)***:** Nature Microbiology, Proc. Nat. Acad. Sci. (PNAS), Applied Environmental Microbiology, Journal of Bacteriology, Biophysical Journal, Communications Biology, Microorganisms, Anaerobe, Journal of Royal Society Interface.

Grant reviewer for international funding agencies: (i) Biotechnology and Biological Sciences Research Council (BBSRC), UK Research and Innovation, United Kingdom (*2023*). (ii) French National Research Agency (ANR), France (*2021*). (iii) Marsden Fund proposal referee for the Royal Society Te Apārangi, New Zealand (*2022*).

Ad hoc reviewer before joining ASU. 2013-2018.

Proc. Nat. Acad. Sci. (PNAS), Biophysical Journal, International Society for Microbial Ecology (ISME) Journal, FEMS Microbiology Letters, Bioresource Technology, Microbial Cell Factories, Anaerobe, Computational and Structural Biotechnology, Scientific Report.

SERVICE AT ASU

Service through committee work or panels at ASU.

1. **2022-present.** School of Life Sciences Charter Initiative committee.
2. **2023-2024.** Biodesign Center for Fundamental and Applied Microbiomics and School of Molecular Sciences tenure track faculty search committee.

3. **2024.** Panelist for the sustainability breakout session at Biodesign Fusion retreat.
4. **2023-2024.** Reimagining School of Life Sciences - social interactions working group.
5. **2023-2024.** Biodesign Chalk talk committee.
6. **2020 and 2021.** School of Life Sciences microbiology graduate admissions committee.
7. **2021.** Poster judge at Biodesign Fusion retreat.
8. **2019.** School of Life Sciences MCB graduate executive/admissions committee.

Thesis committee member of PhD/MS students from other labs at ASU (6 students).

1. Finley W. Thomas (Garci-Pichel lab). Title: TBD
2. Lexi Yakimovich (Haydel lab). Title: TBD.
3. Flavio Beas (Jurutka lab). Title: TBD
4. Daniela Gutiérrez-Muñoz (Bean lab). Title. Can we differentiate between CF lung pathogens solely based on the metabolic volatiles they produce?
5. Keilen Kelly (Misra lab). Title. Osmotic and thermal stress tolerance of RAM3028
6. Luis Gonzalez-de-Salceda (Garcia-Pichel lab). Title. Cell size, ploidy, and ribosomal gene copies: evolutionary patterns and adaptive strategies to deal with nutritional availability**.**

Thesis committee member of Barrett undergraduates from other labs at ASU (5 students).

1. Amber Toy (Shah lab). Title. Tyrosine Metabolism by the Human Microbiome.
2. Piper Heiligenstein (Haydel lab). Title. Deciphering the essentiality of the *Mycobacterium smegmatis* PrrAB two component system
3. Shauna Meshkin (Velazquez lab). Title: TBD
4. Anastasia Culbrick (Velazquez lab). Title: TBD
5. Catherine McInnes (Haydel lab). Title: TBD

PROFESSIONAL DEVELOPMENT

1. 2019, 2021. The College New Assistant Professor Workshop Series. Organized by ASU, Tempe, AZ.
2. 2017. Laboratory Management course for future PI's. Organized by the European Molecular Biology Organization (EMBO) at Harvard University, Cambridge, MA.
3. 2016. Physical Biology of the Cell course, Marine Biological Laboratories, Woods Hole, MA,
4. 2016. Harvard Center for Biological Imaging Workshops, MCB Dept., Cambridge, MA.
5. 2016. DIY Microbiomes and Metabolomes: American Society for Microbiology Meeting, Boston, MA.
6. 2016. Data Visualization with Python, Institute for Advanced Computational Sciences (IACS), Harvard University, Cambridge, MA.
7. 2015. Mini MBA course. Harvard GSAS at Harvard Business School, Cambridge, MA.

TEACHING

TEACHING AT ASU - PRIMARY INSTRUCTOR.

Courses developed/updated and taught at ASU.

1. **BIO/MIC 498/591: Programming for Biologists** (3 credits)**.**
   I developed this course from scratch in 2020 and have been teaching it every spring since then. In the first two offerings (2020 and 2021), the course covered both Python and MATLAB. Based on student feedback, which indicated a stronger interest in Python, I transitioned the course to focus exclusively on Python, emphasizing its applications in biology and the integration of artificial intelligence tools. The course trains students to independently write code for biological data analysis, introduces key concepts in statistical analysis and big data handling, and provides hands-on experience with AI-based approaches for solving biological problems.
   Learning Outcomes:
   - Gain proficiency in installing Anaconda, using the command line interface, and working with core Python libraries.
   - Write and execute Python code in Jupyter Notebook to import, visualize, and analyze biological data. Develop skills in manipulating lists, dictionaries, tuples, and sets, and applying strings, loops, and functions.
   - Apply Python libraries such as *numpy*, *matplotlib*, *pandas*, *seaborn*, *scikit-image*, *sciPY*, and *scikit-learn* for data analysis and visualization.
   - Build an automated particle tracker and perform image analysis.
   - Acquire both conceptual and hands-on understanding of AI applications in biology.
   - Complete a final project by formulating a hypothesis and writing Python scripts to analyze a dataset or automate a biological workflow.

   Student evaluations on a scale of 1 to 5. (1 = excellent, 5 = poor)
   Spring 2025 (19 students): Not available yet.
   Spring 2024 (22 students): 1.2
   Spring 2023 (22 students): 1.5
   Spring 2022 (24 students): 1.5
   Spring 2021 (25 students): 1.3
   Spring 2020 (23 students): 1.5

2. **MIC 220 Biology of Microorganisms** (3 credits)**.**
   This core microbiology course is offered every fall semester. Prior to my involvement, the fall and spring offerings of the course differed significantly, and there was no standardized

textbook across semesters. When I was assigned to co-teach the course with Dr. Efrem Lim in Fall 2022, I led a major overhaul of the syllabus and adopted *Brock Biology of Microorganisms* as the standard textbook. In Fall 2024, Dr. John McCutcheon joined as my co-instructor, and together we further refined the syllabus. Student evaluations have reflected that these updates made the course more engaging and informative.

This course introduces the structural, functional, ecological, and medical aspects of microorganisms. Topics include microbial diversity, cell structure and motility, genetics, metabolism, ecology, and host-microbe interactions, with an emphasis on connecting molecular mechanisms to biological processes. Students also explore microbial genomics, antibiotic resistance, and the evolutionary impact of mobile genetic elements. The course integrates molecular biology, ecology, and medical microbiology to build a comprehensive understanding of the microbial world.

Learning Outcomes:

- Describe the structural and functional characteristics of bacteria, archaea, viruses, and microbial eukaryotes.
- Discuss microscopy and cultivation techniques to study microbial cells and communities.
- Explain key molecular processes in microbial cells, including replication, transcription, translation, gene regulation, and protein secretion.
- Analyze microbial metabolism and predict how microbes derive energy and carbon from different environments.
- Discuss the mechanisms of microbial pathogenesis and host immune responses.
- Interpret the role of microorganisms in natural ecosystems and human health through ecological and genomic approaches.
- Evaluate the impact of microbial evolution, including horizontal gene transfer and mobile genetic elements, on biological innovation and adaptation.

  Student evaluations on a scale of 1 to 5. (1 = excellent, 5 = poor)

  Fall 2024 (75 students): 1.7

  Fall 2023 (93 students): 2.3

  Fall 2022 (88 students): 2.4

3. **BIO/MIC 495 Undergraduate research** (1-3 credits)**.**

   Supervised research in biology/microbiology/molecular biosciences, biotechnology, and/or plant biology.

   Spring 2025, Fall 2024, Spring 2024, Fall 2023, Spring 2023, Fall 2022, Spring 2022, Fall 2021, Spring 2021, Fall 2020. No evaluations.

4. **BIO/MBB 492 Honors Directed Study** (1-6 credits).
   Independent study in which a student, under the supervision of a faculty member conducts research or creative work that is expected to lead to an undergraduate honor thesis or creative project.
   Spring 2025, Fall 2024, Spring 2024, Fall 2023, Spring 2023, Fall 2022, Spring 2022, Fall 2021, Spring 2021, Fall 2020. No evaluations.

5. **BIO 493, Honors Thesis** (1-6 credits).
   Supervised research or creative activity focused on preparation and completion of and undergraduate honors thesis or a creative project.
   Spring 2025, Fall 2024, Spring 2024, Fall 2023, Spring 2023, Fall 2022, Spring 2022, Fall 2021, Spring 2021, Fall 2020. No evaluations.

TEACHING AT ASU – GUEST LECTURER AND MODULES.

6. **MIC 401 Research paper** (1 credit)
   Reader for Fall 2019, Fall 2021.

7. **MIC 501, *Foundations in Microbiology*.**
   Served as a guest instructor, Fall 2020, Fall 2021, Fall 2023, Fall 2024.

TEACHING BEFORE JOINING ASU.

8. Graduate Teaching Assistant, University of Wisconsin-Milwaukee.
   BIO SCI 383: General Microbiology laboratory: Fall 2010, Fall 2009, Spring 2008
   BIO SCI 698: Independent Study in Microbiology: Spring 2010.

MENTORING

MENTORING AT ASU

Current. mentoring 2 postdoctoral fellows, 4 PhD students, and 3 undergraduate researchers in my lab.
Lab alumni. One former postdoctoral fellow recently joined Solenis in Delaware, USA as a Senior Scientist, Microbiology R&D. 11 undergraduate researchers have graduated from my lab while 3 are current. 5 of these have either written or are in the process of writing Barrett honors thesis. 3 have joined biotech companies, 2 joined PhD programs, 2 joined a Medical Schools and 1 joined a Dental School.

Postdoctoral Research Scientist Mentor, Arizona State University (2 current trainees, 1 former trainee)

1. March 2021 – June 2024. Dr. Amanda M. Zdimal, PhD. Published 2 papers. *Current Position* – Senior Scientist, Microbiology R&D, Solenis, DE, USA.
2. Jan 2020 – present. Dr. Abhishek Trivedi, PhD. Published 1 paper, 1 paper is under review and 1 manuscript is in preparation.
3. April 2021 – present. Dr. Jitendrapuri Gosai, PhD. Published 2 papers and 2 manuscripts are in preparation.

PhD student primary advisor, Arizona State University (primary advisor: 3 students, co-advisor: 1 student

1. Fall 2021 – present. Emma Henderson. 2 papers are under review while 2 manuscripts are in preparation. *Received the best talk by a young investigator award at the BLAST Conference in 2025*. Expected graduation: Spring 2026.
2. Fall 2022 – present. Sofia T. Rocha. Published 2 papers while 2 collaborative manuscripts are in preparation. *Received Biodesign travel award in 2022*. Expected graduation: Spring 2027.
3. Fall 2023 - present. Samyabrata Sen. Published 1 paper, 1 paper is under review and 1 manuscript is in preparation. *Received poster award for innovation in environmental solutions at the Biodesign retreat, 2025*. Expected graduation: Spring 2028.
4. Fall 2022 – present. Pavani Dadi (joint SOLS PhD student with D. Shah, SMNS, ASU). Published 1 paper and 1 manuscript is in preparation. Award. *Received American Society for Biochemistry and Molecular Biology Travel Award, 2024*. Expected graduation: Spring 2027.

Primary undergraduate research mentor, Arizona State University (total 14, current 3).

Ravi Manchikalapati (current), Katherine Villegas (current)**,** Alexa Dimayuga (current), Riya Garg (2023-2025), Arad Arasteh (2022-2024), Taryn Collins (2023-2024), Tanya Aftab (2022-2024), Khaled Alhammadi (2022), Kaxandra Nessie (2020-2022), Sofia T. Rocha (2020-2022), Claudia Bauer (2020-2021), Madeleine Zheng (2020-2021), Sehajveer Singh (2019-2020), Maxim Averbukh (2019 -2021).

Barrett undergraduate thesis primary director, Arizona State University (5 students).

1. Katherine Villegas (ongoing, Title; TDB)
2. Ravi Manchikalapati (ongoing, Title; TDB)
3. Riya Garg. 2025. Title: How does the rotary type 9 secretion system of gliding bacteria anchor to the peptidoglycan?
4. Tanya Aftab. 2024. Title. The Role of Type 9 Protein Secretion System in Interspecies Relations between human oral isolates *Capnocytophaga ochracea* and *Streptococcus gordonii*.

5. Kaxandra Nessie. 2022. Title. Peptidyl-Prolyl Cis/Trans Isomerases of *Flavobacterium johnsoniae*.

CONFERENCE TALKS BY TRAINEES:

1. Jitendra Gosai (Postdoctoral Fellow).
    - BLAST Meeting, 2025, Cancun, Mexico,
    - BioPhest Biological Physics Conference, 2024, Tempe, AZ.
2. Abhishek Trivedi (Postdoctoral Fellow).
    - Society for Molecular Biology and Evolution Satellite Meeting, 2023, Tempe, AZ.
    - CFAM Retreat, 2022, Fort McDowell, AZ.
3. Amanda Zdimal (Postdoctoral Fellow).
    - ASU Postdoctoral Fellow Conference, 2023, Tempe, AZ
4. Emma C. Henderson (PhD student).
    - BLAST Meeting, 2025, Cancun, Mexico,
5. Sofia T. Rocha (PhD student).
    - American Association of Dental, Oral, and Craniofacial Research (AADOCR) Annual Conference, 2023, Portland, OR.
    - CFAM Retreat, 2022, Fort McDowell, AZ.
6. Pavani Dadi (PhD student).
    - American Society for Biochemistry and Molecular Biology (ASBMB) Annual Meeting, 2024, San Antonio, TX.
7. Nichith Ratheesh (Research Technician).
    - Biodesign Fusion Flash talk, 2021, Tempe, AZ.

POSTER PRESENTATIONS BY TRAINEES:

8. Jitendra Gosai (Postdoctoral Fellow).
    - Gordon Research Conference on Sensory Transduction in Bacteria (GRC-STIM), 2022, Ventura, CA.
    - Biodesign Fusion Retreat, 2024.
9. Abhishek Trivedi (Postdoctoral Fellow).
    - Gordon Research Conference on Sensory Transduction in Bacteria (GRC-STIM), 2022, Ventura, CA.
    - Biodesign Fusion Retreat 2022.
10. Sofia T. Rocha (PhD student).
    - Gordon Research Conference on Sensory Transduction in Bacteria (GRC-STIM), 2022, Ventura, CA.
    - Biodesign Fusion Retreat 2024
11. Emma Henderson (PhD student).

- BLAST conference, 2023, Charleston, SC.
- Biodesign Fusion Retreat 2024

12. Samyabrata Sen (PhD student).
    - BLAST conference, 2025, Cancun, Mexico.
    - Biodesign Fusion Retreat 2025
13. Amanda Zdimal (Postdoctoral Fellow).
    - BLAST conference, 2023, Charleston, SC.

UNDERGRADUATE RESEARCH MENTORSHIP PRIOR TO JOINING ASU (TOTAL 9).

Mentored seven undergraduate students in Independent Research at Harvard University. Cambridge, MA and two undergraduate researchers at University of Wisconsin-Milwaukee.

Harvard University**:** 2017: (i) Yisha Tang (ii) Visha Patel. **2016**: (iii) Marcela Rodriguez, Brazilian Science Mobility Program. 2015: (iv) Natalia Dorea, Brazilian Science Mobility Program. (v) Pan Xia. 2014: (vi) Liyuan Zheng (vii) Emma Perrier. ***University of Wisconsin-Milwaukee.*** 2008-2013: (viii) Halley Pucker (ix) Joseph J. Johnston.