Curriculum vitae

Ritu R. Raj
ritu.raj@colorado.edu

Education and Training

Ph.D. - Chemical Engineering — est. 2025
- University of Colorado Boulder, Advisors: Prof. Ankur Gupta and Prof. C. Wyatt Shields IV

M.S. - Chemical Engineering — 2023
- University of Colorado Boulder, Advisors: Prof. Ankur Gupta and Prof. C. Wyatt Shields IV

B.S. - Chemical Engineering — 2021
- California State Polytechnic University Pomona, Advisor: Prof. Laila Jallo

Publications **equal contribution*

4. **Raj, RR**; Ganguly, A; Becker, C; Shields IV, CW; Gupta, A; "Motion of an active bent-rod with an articulating hinge: Exploring mechanical and chemical modes of swimming" *Frontiers in Physics*, 2023, **11**, **DOI:10.3389/fphy.2023.1307691**

3. Lee, JG*; **Raj, RR***; Day, NB*; Shields IV, CW. "Opportunities and unsolved challenges for clinical translation of medical microrobots" *ACS Nano*, 2023, **17**, 14196–14204, **DOI:10.1021/acsnano.3c03723**

2. Lee, JG; **Raj, RR**; Thome, CP; Day, NB; Martinez, P; Bottenus, N; Gupta, A; Shields IV, CW. "Bubble-based microrobots with rapid circular motion for epithelial pinning and drug delivery" *Small*, 2023, 2300409, **DOI:10.1002/smll.202300409**

1. **Raj, RR**; Shields IV, CW; Gupta, A. "Two-dimensional diffusiophoretic colloidal banding: optimizing the spatial and temporal design of solute sinks and sources" *Soft Matter*, 2023, **19**, 892-904 **DOI:10.1039/D2SM01549H**, Selected as *Soft Matter* HOT Article

Honors and Awards

Graduate Award in Service to the Department - Teaching and Mentoring	2024
NSF Graduate Research Fellowship	2023 - Present
Graduate Assistanceship in Areas of National Need - Soft Materials	2023
Colorado Diversity Initiative Diversity Fellowship	2021
ChBE First Year Graduate Fellowship	2021
NSF LSAMP Fellow	2020

Invited Presentations **presenting author*

1. **Raj, RR***, Gupta, A, Shields IV, CW. **Talk Titled:** *Rational design of the frequency response of microrobots powered by acoustic streaming*, CU Boulder Innovation in Materials Symposium, Boulder, CO, 08/2024

Contributed Presentations **presenting author*

20. **Raj, RR***, Gupta, A, Shields IV, CW. **Talk Titled:** *Frequency-dependent streaming flows from acoustically actuated bubbles and sharp edges*, APS Division of Fluid Dynamics, Salt Lake City, UT, 11/2024

19. Morgan, B*, **Raj, RR***, Carr, D*, Scout, W*. **Talk Titled:** *Why it's important to teach my subject to non-majors*, Center for Teaching and Learning - Fall Intensive, Boulder, CO, 08/2024

18. **Raj, RR***, Day, NB, Loomis, N, Cutting, E, Gupta, A, Shields IV, CW. **Talk Titled:** *Macrophage transport with helical microrobots: Cell attachment, locomotion, and delivery through mucus*, ACS Fall Meeting, Denver, CO, 08/2024

17. **Raj, RR***, Gupta, A, Shields IV, CW. **Talk Titled:** *Design-driven motion of microrobots powered by acoustic streaming flows*, ACS Fall Meeting, Denver, CO, 08/2024

16. **Raj, RR***, Ganguly, A, Becker, C, Shields IV, CW, Gupta, A. **Talk Titled:** *Exploring the chemical and mechanical modes of swimming of a bent rod actuator*, Rocky Mountain Fluid Mechanics Research Symposium, Boulder, CO, 08/2024

15. **Raj, RR***, Gupta, A, Shields IV, CW. **Poster Titled:** *Engineering physical intelligence in microrobots through geometry and field responsiveness: Exploring chemical, magnetic and acoustic propulsion mechanisms.*, Gordon Research Conferences, Ventura, CA, 01/2024

14. **Raj, RR***, Day, NB, Cutting, E, Loomis, N, Gupta, A, Shields IV, CW. **Poster Titled:** *Transporting macrophages with magnetic helical microrobots*, APS Division of Fluid Dynamics, Washington, D.C., 11/2023

13. **Raj, RR***, Lee, JG, Gupta, A, Shields IV, CW. **Talk Titled:** *Effect of geometric design on the motion of microrobots due to acoustic streaming flows*, APS Division of Fluid Dynamics, Washington, D.C., 11/2023

12. **Raj, RR***, Shields IV, CW, Gupta, A. **Talk Titled:** *Diffusiophoretic colloidal highways: Optimizing the colloidal banding induced by two-dimensional solute gradients*, ACS Colloid and Surface Science Symposium, Raleigh, NC, 06/2023

11. **Raj, RR***, Lee, JG, Gupta, A, Shields IV, CW. **Talk Titled:** *Impact of geometry on the frequency-dependent response of acoustic microrobots*, ACS Colloid and Surface Science Symposium, Raleigh, NC, 06/2023

10. **Raj, RR***, Day, NB, Cutting, E, Loomis, N, Shields IV, CW. **Poster Titled:** *Helical microrobot-mediated transport of immune cells in rotating magnetic fields*, ACS Colloid and Surface Science Symposium, Raleigh, NC, 06/2023

9. **Raj, RR***, Shields IV, CW, Gupta, A. **Talk Titled:** *Rational design of two-dimensional colloidal banding*, American Physical Society Division of Fluid Dynamics Annual Meeting, Indianapolis, IN, 11/2022

8. **Raj, RR**, Shields IV, CW, Gupta, A*. **Talk Titled:** *Two-Dimensional Diffusiophoretic Banding of Colloidal Particles*, AIChE Annual Meeting, Phoenix, AZ, 11/2022

7. **Raj, RR***, Shields IV, CW, Gupta, A. **Talk Titled:** *Colloidal banding of diffusiophoretic particles in two-dimensional solute gradients*, Rocky Mountain Fluid Mechanics Research Symposium, Boulder, CO, 08/2022

6. **Raj, RR***, Shields IV, CW, Gupta, A. **Talk Titled:** *Programmable two-dimensional colloidal banding of diffusiophoretic particles*, ACS Colloid and Surface Science Symposium, Golden, CO, 07/2022

5. Ganguly, A, **Raj, RR**, Gupta, A*. **Talk Titled:** *Impact of surface heterogeneity on diffusiophoresis of colloids in a mixture of electrolytes and non-electrolytes*, ACS Colloid and Surface Science Symposium, Golden, CO, 07/2022

4. Lee, JG*, **Raj, RR**, Thome, CP, Gupta, A, Shields IV, CW. **Talk Titled:** *Bubble-based Acoustic Propellers for Sustained Corticosteroid Delivery in the Bladder*, ACS Colloid and Surface Science Symposium, Golden, CO, 07/2022

3. **Raj, RR***, Carter, J, Gupta, A, Shields IV, CW. **Poster Titled:** *Dynamics of Helical Particles in Biologically Relevant Fluids*, ACS Colloid and Surface Science Symposium, Golden, CO, 07/2022

2. **Raj, RR***, Jallo, L. **Talk Titled:** *Model based design – Transdermal aspirin delivery*, Cal Poly Pomona Engineering Project Showcase and Symposium, Pomona, CA, 05/2021

1. **Raj, RR***, Ahmad, A, Mendoza, A, Jagadish, P, Blas, R, Jallo, L. **Talk Titled:** *Emulgel based transdermal patch for aspirin delivery*, Cal Poly Pomona Engineering Project Showcase and Symposium, Pomona, CA, 05/2020

Teaching

Lead TA: Chemical and Biological Engineering 2024-2025AY
- Lead TA Mentor: Prof. Andrew Holewinski

Advanced Teaching Assistant: Transport Phenomena, Chemical and Biological Engineering S2024
- Course Instructor: Prof. Ankur Gupta

Teaching Assistant: Physical Chemistry for Engineers, Chemical and Biological Engineering S2022
- Course Instructors: Prof. Andrew Goodwin and Prof. Charles Musgrave

Supplemental Instructor: Applied Math in Chem. Eng., Chemical and Materials Engineering 2020-2021
- Course Instructors: Prof. Mingheng Li and Prof. Thuan Nguyen

Supplemental Instructor: Material and Energy Balances, Chemical and Materials Engineering 2019-2020
- Course Instructors: Prof. Laila Jallo and Prof. Marta AmirSadeghi

Students Mentored

Undergraduate students

4. Nichole Loomis (08/2023 - 05/2024, ChBE, Senior Thesis, co-mentored with Nicole Day)
3. Cora Becker (03/2023 - Present, ChBE, DLA grant, Senior Thesis)
2. Elizabeth Cutting (10/2022 - 08/2023, 06/2024 - Present, Comp. Sci., BSI grant, UPLIFT grant, UROP grant, DLA grant)
1. Jackson Carter (06/2022-08/2022, 08/2024-Present, ChBE, SPUR grant, Senior Thesis)

Professional Experience

Project Management Intern, PSC Biotech 2020

Engineering Technician, Department of Defense, Edwards AFB 2019

External Service

Community Involvement

Discovery Learning Apprenticeship, Graduate Research Mentor	08/2023 - Present
Undergraduate Research Opportunities Program, Graduate Research Mentor	06/2024 - 09/2024
Colorado State Science and Engineering Fair, Head Judge	04/2024
Boulder Valley School District Science and Engineering Fair, Head Judge	03/2024
BSI Research Program, Graduate Research Mentor	06/2023 - 08/2023
Colorado State Science and Engineering Fair, Judge	04/2023
STEM Routes Uplift Research Program, Graduate Research Mentor	10/2022 - 05/2023
CU Science Discovery, Northglenn High School, Graduate Student Mentor	09/2022 – 05/2023
Chemical and Biological Engineering, Peer Mentor	08/2022 - 06/2023
Summer Program for Undergraduate Research, Graduate Student Mentor	06/2022 - 08/2022
Maximizing Engineering Potential, Educational Content Creator	08/2019 – 05/2021
International Society for Pharmaceutical Engineering, President	06/2020 – 05/2021
Maximizing Engineering Potential, Peer Mentor	06/2020 – 05/2021

Journal Reviews

Science Robotics, Lab on a Chip