

Arkava Ganguly

Chemical and Biological Engineering, University of Colorado Boulder

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Education

Ph.D. in Chemical Engineering, University of Colorado Boulder

Aug, 2021 - Dec, 2025

Advisor: Prof. Ankur Gupta

Research: My research centers on the theoretical and computational modeling of multiscale transport phenomena in electrokinetic, colloidal, and electrochemical systems. I develop analytical and numerical models to investigate coupled fluid, mass, and charge transport in confined and complex environments. Applications span microparticle propulsion, ion transport in charged nanopores, and phoretic mobility in complex media. My work integrates asymptotic analysis, numerical simulations, and semi-analytical methods, with a focus on deriving mechanistic insights relevant to energy, biomedical, and separation technologies.

M.S. in Chemical Engineering, University of Colorado Boulder

2021-2023

B.E. in Chemical Engineering, Jadavpur University

2016-2020

Honors and Awards

American Institute of Chemists Graduate Student Award, University of Colorado Boulder

2025

Mukhopadhyay Graduate Research Fellowship, University of Colorado Boulder

2025, 2022

Teets Family Endowed Doctoral Fellowship, University of Colorado Boulder

2023

Workshop Fellowship, Isaac Newton Institute for Mathematical Sciences

2023

H.L. Roy Memorial Gold Medal, Jadavpur University

2020

Publications (* denotes equal contribution)

1. **Ganguly, A.**, & Gupta, A., Chapter 2: "Diffusiophoresis and Diffusioosmosis in Electrolyte Solutions." Diffusiophoresis and Diffusioosmosis: Theory, Experiment and Applications. Royal Society of Chemistry (*in prep*).
2. Romero, P.N.*, **Ganguly, A.***, Gupta, A., Vigil-Fowler, D., Smith, W.A., Ion Transport in Charged Membranes: Insights into the dependence of driving forces on pore size. (*in prep*)
3. Duong, D.Q., **Ganguly, A.**, Gupta, A., Shin, S., Salt mediated non-monotonic propulsion of oil droplets in confined spaces. (*in press*, *Newton*)
4. **Ganguly, A.***, Roychowdhury, S.* , & Gupta, A. (2024). Unified mobility expressions for externally driven and self-phoretic propulsion of particles. *Journal of Fluid Mechanics*, 994, A2.
5. Raj, R., **Ganguly, A.**, Becker, C., & Gupta, A., Motion of an active bent rod with an articulating hinge: exploring mechanical and chemical modes of swimming. *Front. Phys.* 11:1307691.
6. **Ganguly, A.**, Alessio, B.M., & Gupta, A. (2023), Diffusiophoresis: a novel transport mechanism - fundamentals, applications, and future opportunities. *Front. Sens.* 4:1322906.
7. Lee, J. G.* , Thome, C. P.* , Cruse, Z. A., **Ganguly, A.**, Gupta, A., & Shields, C. W. (2023). Magnetically locked Janus particle clusters with orientation-dependent motion in AC electric fields. *Nanoscale*, 15(40), 16268-16276.
8. **Ganguly, A.**, & Gupta, A. (2023). Going in circles: Slender body analysis of a self-propelling bent rod. *Physical Review Fluids*, 8(1), 014103.
9. **Ganguly, A.***, Bairagya, P.* , Banerjee, T., & Kundu, D. (2022). Application of nature-inspired algorithms with generalized Pitzer-Debye-Hückel (PDH) refinement for liquid-liquid equilibria (LLE) correlation in cyclic di-ether systems. *AICHe Journal*, 68(2), e17434.

Work and Research Experience

Junior Research Fellow, Process Development, National Chemical Laboratory, India

11/2020-05/2021

Analyzed non-coding genomic variation to understand links with organ-specific diseases; developed statistical models in R for large-scale genome data; identified repeating patterns tied to brain and heart defects; laid the foundation for an ongoing full-genome defect prediction framework.

- Junior Research Fellow**, Green Solvent Laboratory, IIT Guwahati 04-10/2020
Addressed poor separation efficiency of carcinogenic cyclic di-ethers using liquid-liquid (LL) phase splitting; optimized binary interaction parameters for NRTL/UNIQUAC using MATLAB Global Optimization Toolbox; developed GA-based UNIQUAC model with long-range interaction to capture LL equilibrium in ionic liquids; reduced uncertainty in LL equilibrium prediction from 1.22% to 0.05%, and improved prediction accuracy in ionic liquids by 33%.
- Engineering Trainee**, Syngas Technology Development, Haldor Topsoe 05-07/2019
Tasked with reducing energy usage in proprietary Steam Methane Reformer technology; optimized oxygen enrichment levels via FORTRAN-based process simulator; performed techno-economic analysis; achieved 56.8% reduction in fuel consumption.
- Project Consultant**, BHAVINI, Department of Atomic Energy, India 12/2018-01/2019
Investigated pump failure in the secondary cooling loop of fast breeder reactor; used CFD (SolidWorks) and Magnetohydrodynamic simulations (COMSOL) to analyze electromagnetic and flow instabilities; worked within safety and design protocols to identify design flaws and proposed fixes predicted to reduce flow instability by 20%.
- Summer Research Intern**, Instability and Soft Patterning Laboratory, IIT Kharagpur 05-07/2018
Studied secondary wrinkle-induced wetting variation on biomimetic substrates; performed metal evaporation, soft lithography, and goniometry; characterized surfaces using SEM and AFM; gained insight into how surface morphology affects wettability.
- Invited presentations** (# denotes presenting author)
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1. **Ganguly, A.**#, Gupta, A., Impact of Geometric Variations, Surface Heterogeneities, and Confinement on the Self-Propulsion of Microparticles, Department of Chemical Engineering, University of California Davis, 2024.
 2. **Ganguly, A.**, Alessio, B. M., Gupta, A.#, Theoretical Framework for Investigating the Late-Time Dynamics of Active Droplets via Surfactant Adsorption and Desorption, ACS Colloid and Surface Science Symposium 2023 (*Keynote talk*).
- Contributed presentations and posters** (# denotes presenting author)
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1. **Ganguly, A.**#, Raj, R., Suarez Davila, P., Becker, C., Gupta, A., Chemical and Mechanical Actuation of Bent-Rod Microparticles Near a Wall, AIChE Annual Meeting 2025.
 2. **Ganguly, A.**#, Roychowdhury, S., Cruse, Z.A., Gupta, A., A Theoretical Study of the Phoretic Motion of Patchy Spherical and Spheroidal Particles through Unified Mobility Expressions, AIChE Annual Meeting 2025.
 3. **Ganguly, A.**#, Multiphysics Modeling of Phoretic and Inertial Particle Dynamics, AIChE Annual Meeting 2025.
 4. **Ganguly, A.**#, Roychowdhury, S., Cruse, Z.A., Gupta, A., Unified mobility expressions for externally driven and self-phoretic propulsion of particles, APS Division of Fluid Dynamics 2024.
 5. Suarez Davila, P.#, **Ganguly, A.**, Raj, R., Gupta, A., Flow Visualization of a Marangoni Surfer: Relating Flow to Surfer Motion, American Institute of Chemical Engineers Annual Student Conference 2024 (Poster).
 6. **Ganguly, A.**#, Raj, R., Becker, C., Gupta, A., Beyond the scallop theorem: Exploring combined mechanical and chemical propulsion mechanisms of a bent rod actuator, ACS Fall Symposium 2024.
 7. **Ganguly, A.**#, Roychowdhury, S., Gupta, A., Unified mobility expressions for externally driven and self-phoretic propulsion of particles, ACS Fall Symposium 2024.
 8. **Ganguly, A.**#, Roychowdhury, S., Gupta, A., Unified mobility expressions for externally driven and self-phoretic propulsion of particles, Rocky Mountain Fluid Mechanics Research Symposium 2024.
 9. Suarez Davila, P.#, **Ganguly, A.**, Raj, R., Gupta, A., Flow Visualization of a Marangoni Surfer: Relating Flow to Surfer Motion, Young Scholars Summer Research Program Symposium, University of Colorado Boulder 2024 (Poster).
 10. **Ganguly, A.**#, Raj, R., Becker, C., Gupta, A., Motion of catalytically active bent rods with an articulating hinge, ACS Colloids and Surface Science Symposium 2024.
 11. **Ganguly, A.**#, Roychowdhury, S., Gupta, A., A unified mobility expression for externally driven and self-phoretic propulsion of particles, ACS Colloids and Surface Science Symposium 2024.
 12. **Ganguly, A.**#, Roychowdhury, S., Gupta, A., Impact of interaction potential lengthscale and surface heterogeneity on phoretic and autophasoretic mobilities: Moving beyond the slip velocity approach, Annual Meeting of the APS Division of Fluid Dynamics 2023.

13. **Ganguly, A.**[#], Alessio, B.M., Gupta, A., Effect of interfacial surfactant transport on the late-time dynamics of Marangoni stress-driven droplets, Annual Meeting of the APS Division of Fluid Dynamics 2023 (*Poster*).
 14. **Ganguly, A.**, Raj, R., Roychowdhury, S., Cruse, Z., Becker, C., Gupta, A.[#], Predicting Trajectories of Catalytically-Driven Self-Propelling Particles Under Geometric Asymmetries and Surface Heterogeneities, AIChE Annual Meeting 2023.
 15. Cruse, Z.[#], **Ganguly, A.**, Gupta, A., Trajectories of self-diffusiophoretic spherical particles with arbitrarily shaped catalytic patches, ACS Colloid and Surface Science Symposium 2023 (*Poster*).
 16. Roychowdhury, S., **Ganguly, A.**[#], Gupta, A., Impact of interaction potential length scale and surface heterogeneity on the trajectories of self-phoretic microswimmers, ACS Colloid and Surface Science Symposium 2023.
 17. **Ganguly, A.**[#], Gupta, A., Self-propelling bent-rods move in a circle: a slender-body analysis, ACS Colloid and Surface Science Symposium 2023.
 18. **Ganguly, A.**, Cruse, Z., Gupta, A.[#], Control of phoretic self-propulsion of asymmetric particles, AIChE Annual Meeting 2022.
 19. **Ganguly, A.**[#], Gupta, A., To turn or not to turn: Slender body analysis for a self-propelling axially asymmetric bent rod, Annual Meeting of the APS Division of Fluid Dynamics 2022.
 20. **Ganguly, A.**[#], Gupta, A., A theoretical framework to understand diffusiophoretic self-propulsion of slender bent rods, Rocky Mountain Fluid Mechanics Research Symposium 2022.
 21. **Ganguly, A.**, Raj, R., Gupta, A.[#], Impact of surface heterogeneity on diffusiophoresis of colloids in a mixture of electrolytes and non-electrolytes, ACS Colloid and Surface Science Symposium 2022.
 22. **Ganguly, A.**[#], Gupta, A., Control of Phoretic Self-Propulsion through Particle Geometry: Slender Body Analysis for an Asymmetric Bent Rod, ACS Colloid and Surface Science Symposium 2022.

Teaching

Helped prepare homework assignments, set grading rubrics, held office hours, and graded exams.

Mentorship

Paloma Suárez Davila - undergraduate research mentee, current position: PhD student in UCSB 2024-2025

Awards and Honors: Poster award in Materials Science category at AIChE 2024, poster award in Materials category at Young Scholars Summer Research Program Symposium 2024.

Zoe Cruse - undergraduate research mentee, current position: PhD student in U. Michigan 2022-2024

Awards and Honors: NSF Graduate Research Fellowship, Recipient of CU Boulder College of Engineering and Applied Science Research Award, poster award in the Materials Science category at AIChE 2023.

Graduate peer mentee: Mohammed Amin (2025), Anthony Gullion (2024), Souradeep Roychowdhury (2022), Julia Callejon (2022).

Volunteering and Community Service

In 2024, I contributed to the academic and professional community as a reviewer for the **Journal of Colloid and Interface Science** and **Frontiers in Mechanical Engineering**, as well as a judge for the **Young Scholars Summer Research Program** Poster Competition. In association with **CU Boulder's Office of Precollege Outreach and Engagement**, I designed interactive problem-solving activities to teach concepts such as energy density, supercapacitor operation, and trade-offs between specific power and energy. Since 2022, I have also served on **CU Boulder's ChBE Graduate Leadership Committee**, where I worked on the Diversity Committee to foster inclusion through monthly coffee hours and on the Professional Development Committee to expand career programming, co-founding the “Industry Connect” seminar series, hosting invited speakers, and organizing the ENG-IN Symposium that connected 100+ students with more than 25 industry professionals.