

# Fan Yang

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## EDUCATION AND TRAINING

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Post-doctoral Scholar in Biology and Biological Engineering, <b>California Institute of Technology</b> Supervisor: Prof. Matt Thomson	2021 - Present Pasadena, CA
PhD in Department of Mechanical and Aerospace Engineering, <b>Princeton University</b> Supervisor: Prof. Howard A. Stone Thesis: Interfacial Flows in Active Matter and Energy Processes	2015 - 2021 Princeton, NJ
Bachelor of Engineering in Mechanical Engineering, <b>Tsinghua University</b> GPA: 92.2/100 Ranking: 1st/84 Thesis: Numerical Simulations of Continuous Casting with Electromagnetic Stirring	2011 - 2015 Beijing, China

## PUBLICATIONS

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1. **F. Yang**, S. Liu, H. J. Lee, R. Phillips and M. Thomson. Dynamic Flow Control Through Active Matter Programming Language. *Nature Materials*, 24, 615-625, 2025.  
★ *Nature Materials* News & Views: “Illuminating active matter by harnessing light for modular flow control”.  
★ *Nature Chemical Engineering* Research Highlight: “Programming fluid flow with biological active matter”.  
★ *Caltech News*: “First Programming Language for Active Material”.
2. **F. Yang**, S. Liu, H. Wang, H. J. Lee, R. Phillips and M. Thomson. Geometry-Dependent Defect Merging Induces Bifurcated Dynamics in Active Networks. *Physical Review Research*, 7, L042006, 2025.
3. S. Liu, R. W. Pan, H. J. Lee, S. Shadkhoo, **F. Yang**, C. Li, Z. Qu, R. Phillips and M. Thomson. Force Propagation in Active Cytoskeletal Networks. arXiv:2401.04217. 2024
4. Z. Qu, D. Schildknecht, S. Shadkhoo, E. Amaya, J. Jiang, H. J. Lee, D. Larios, **F. Yang**, R. Phillips and M. Thomson. Persistent fluid flows defined by active matter boundaries. *Communications Physics*, 4, 198, 2021.
5. **F. Yang**. Interfacial flows in active matter and energy processes. Princeton University, 2021.
6. **F. Yang**, A. A. Pahlavan, S. Mendez, M. Abkarian and H. A. Stone. Towards improved social distancing guidelines: space and time dependence of virus transmission from speech-driven aerosol transport between two individuals. *Physical Review Fluids (Rapid Communication)*, 5, 122501, 2020.  
★ Selected as *Editors’ Suggestion*.
7. A. Khodak, **F. Yang**, and H. A. Stone. Free-Surface Liquid Lithium Flow Modeling and Stability Analysis for Fusion Applications. *Journal of Fusion Energy*, 39, 455-461, 2020.

8. M. Abkarian, S. Mendez, N. Xue, **F. Yang**, and H. A. Stone. Speech Can Produce Jet-like Transport Relevant to Asymptomatic Spreading of Virus. *Proceedings of the National Academy of Sciences of the United States of America*, 202012156, 2020.
9. **F. Yang**, H. A. Stone, Formation, rupture, and healing of an annular viscous film, *Physical Review Letters*, 124, 224501, 2020.
10. T. S. Chan, **F. Yang**, A. Carlson, Directional spreading of a viscous droplet on a conical fibre, *Journal of Fluid Mechanics*, 894, A26, 2020.
11. B. Rallabandi, **F. Yang**, H. A. Stone, Motion of hydrodynamically interacting active particles, arXiv:1901.04311.
12. **F. Yang**, B. Rallabandi, H. A. Stone, Autophoresis of two adsorbing/desorbing particles in an electrolyte solution, *Journal of Fluid Mechanics*, 865, 440-459, 2019.
13. **F. Yang**, A. Khodak, H. A. Stone, The effects of a horizontal magnetic field on the Rayleigh-Taylor instability, *Nuclear Materials and Energy*, 18, 175-181, 2019.
14. **F. Yang**, S. Shin, H. A. Stone, Diffusiophoresis of a charged drop, *Journal of Fluid Mechanics*, 852, 37-59, 2018.

## RESEARCH EXPERIENCE

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### California Institute of Technology

2021 - Present

*Post-doctoral Scholar, Biology & Biological Engineering*

*Pasadena, CA*

- Developing a physics-informed ML pipeline that **infers cell velocities from static histology** and integrates them with **spatial transcriptomics of human glioblastoma** to uncover gene-motility couplings in tumor progression.
- Led the creation of a **light-programmable microtubule-motor platform** that sculpts on-demand micron-scale flows for cell sorting, vesicle division and active mixing; first-author paper in *Nature Materials* (2025).
- Discovered a **geometry-controlled bifurcation** in the active healing of cytoskeletal networks; validated continuum theory with an elastic model.

### Princeton University

2015 - 2021

*Graduate Research Assistant, Mechanical & Aerospace Engineering*

*Princeton, NJ*

- Developed theory of **diffusiophoresis of charged droplets** and **autophoresis of interacting particles**.
- Revealed universal thinning and **self-healing of annular viscous films**; published in *Physical Review Letters*.
- Led a COVID-era study of **speech-driven aerosol transport**, generating joint space-and-time distancing guidelines.
- Collaborated with Princeton Plasma Physics Laboratory on **magneto-hydrodynamic stability** of liquid-metal films for fusion reactors.

### Tsinghua University

2013 - 2015

*Undergraduate Researcher, Mechanical Engineering*

*Beijing, China*

- Simulated electromagnetic stirring in continuous-casting processes.

## TEACHING AND MENTORING

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## California Institute of Technology

Mentor for undergraduate Summer Undergraduate Research Fellowship (SURF): 2025 Summer

## Princeton University

Assistant Instructor: MAE 305 Mathematics in Engineering, 2020 Fall  
Assistant Instructor: MAE 305 Mathematics in Engineering, 2018 Fall  
Assistant Instructor: MAE 335 Fluid Dynamics, 2018 Spring  
Assistant Instructor: MAE 223 Modern Solid Mechanics 2017 Fall

## PROFESSIONAL ACTIVITIES

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**Peer Reviewer:** 2017 - Present  
*PNAS, Journal of Fluid Mechanics, Physical Review Fluids, Physical Review E, Nuclear Materials and Energy.*

**Application Reviewer:**  
Summer Undergraduate Research Fellowships (SURF) program, Caltech. 2022

**Organizer** (as a member of the organizing committee and chair of the plenary session):  
9th Gotham-Metro Condensed Matter Meeting, New York University, NY. 2019

**Professional Societies:**  
American Physical Society (APS)  
American Institute of Chemical Engineers (AIChE)

## FELLOWSHIPS AND AWARDS

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Biology and Biological Engineering Divisional Fellowship: Caltech, 2022–2024  
Wallace Memorial Fellowship: Princeton University, 2019  
School of Engineering and Applied Science Award for Excellence: Princeton University, 2018  
Guggenheim Second Year Fellowship: Princeton University, 2016  
Sayre Award for Academic Excellence: Princeton University, 2016  
George W. Riesz '50 \*52 SEAS Fellowship: Princeton University, 2016  
National Scholarship: Tsinghua University, 2013  
Sinopec Scholarship: Tsinghua University, 2012

## SEMINARS AND PRESENTATIONS

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*Active Healing of Microtubule-Motor Networks*  
77th Annual Meeting of the APS Division of Fluid Dynamics, Salt Lake City, Utah 2024  
*Dynamic Flow Control Through Active Matter Programming Language*  
76th Annual Meeting of the APS Division of Fluid Dynamics, Washington, DC 2023  
*Mixing and Stretching in Microfluidics with Active Matter*  
74th Annual Meeting of the APS Division of Fluid Dynamics, Phoenix, AZ 2021  
*The healing of a viscous annular thread and formation of an entrained bubble- fingerprints of dripping of a viscous film*  
72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, WA 2019  
*Dripping of a Thin Viscous Film*  
71st Annual Meeting of the APS Division of Fluid Dynamics, Atlanta, GA 2018  
*Autophoresis of Two Particles with Surface Chemical Reactions*  
70th Annual Meeting of the APS Division of Fluid Dynamics, Denver, CO 2017  
*Diffusiophoresis of a Charged Drop*  
91st Colloid and Surface Science Symposium, New York City, NY 2017  
*Diffusiophoresis of a Charged Drop*  
69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR 2016

## REFERENCES

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**Dr. Matt Thomson,**  
mthomson@caltech.edu  
Professor of Computational Biology

Caltech  
Pasadena, CA

**Dr. Howard A. Stone,**  
hastone@princeton.edu  
Neil A. Omenn '68 University Professor of Mechanical and Aerospace Engineering

Princeton University  
Princeton, NJ

**Dr. Rob Phillips,**  
phillips@pboc.caltech.edu  
Fred and Nancy Morris Professor of Biophysics, Biology, and Physics

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Pasadena, CA