



YAN ZHANG

Postdoctoral Scholar Research Associate
Division of Chemistry & Chemical Engineering
California Institute of Technology

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she/her/hers

RESEARCH INTEREST

My research program designs cell-free expression systems that replicate the intracellular environments of pathogens and other unculturable bacteria, enabling the development of bacteriophages, viruses that infect bacteria, for phage therapy against antimicrobial resistance and biopesticides for sustainable agriculture.

EDUCATION

Georgia Institute of Technology, Atlanta, GA 2022
Doctor of Philosophy in Chemical & Biomolecular Engineering
Thesis: New Interfaces to Advance Point-of-Care Biosensor Diagnostics

Cornell University, Ithaca, NY 2017
Bachelor of Science in Chemical & Biomolecular Engineering

RESEARCH EXPERIENCE

NIH MOSAIC K99/R00 Postdoctoral Fellow, Caltech 2024
Advisor: Prof. William M. (Bill) Clemons, Division of Chemistry and Chemical Engineering

- Optimize cell-free expression system to produce biomedical- and agricultural-relevant bacteriophage expression

This independent research direction has received a total of \$290,000 in funding from Caltech's internal research awards and the NIH MOSAIC K99/R00 Postdoctoral Career Transition Award (\$1 million support for 5 years).

Presidential Postdoctoral Fellow, Caltech 2022
Advisor: Prof. Richard M. Murray, Division of Biology and Biological Engineering

- Identified and resolved proteomic and biochemical factors contributing to batch-to-batch and interlaboratory cell-free system variability in productivity.

This work was supported by Caltech's Presidential Postdoctoral Fellowship and resulted in 1 first and corresponding author publication in *ACS Synthetic Biology*.

Graduate Research Assistant, Georgia Tech 2017
Advisor: Prof. Mark P. Styczynski, School of Chemical & Biomolecular Engineering

- Interfaced cell-free biosensors with polymer biphasic system for multiplexed analyte detection
- Integrated cell-free biosensors to personal glucose monitors for analyte quantification
- Characterized different lysate preparation methods on cell-free system yield and metabolism

This work has resulted in 7 publications in *Nature Communications*, *Science Advances*, *ACS Synthetic Biology*, *PLoS Biology*, *Journal of Chemical Engineering Data*.

Undergraduate Research Assistant, Cornell University 2013

Advisors: Prof. Julius B. Lucks (now at Northwestern University) and Prof. Jeffrey D. Varner, School of Chemical and Biomolecular Engineering

- Simulated RNA negative autoregulation network using mass action kinetics models
- Prototyped RNA networks in cell-free systems and implemented design in *E. coli* cells

This work resulted in 1 third-author publication in *ACS Synthetic Biology* and 1 second-author manuscript in preparation for journal submission.

GRANT WRITING EXPERIENCE

Caltech Resnick Sustainability Center Explorer Grant (Funded for \$150k) 2025

"A Host-Independent, Cell-Free Biomanufacturing Platform to Produce Plant Pathogen-Targeting Bacteriophages for Sustainable Agricultural Biocontrol"

Yan Zhang (conceived and authored the proposal), Bil Clemons (PI), Richard Murray (Co-PI)

Caltech Center for Evolutionary Science Seed Grant (Funded for \$20k) 2025

"Deciphering the Evolution of Protein Cages with Deep Learning"

Zachary Martinez, Yan Zhang (co-conceived and co-authored the proposal), Matt Thomson (PI), Bil Clemons (Co-PI)

NIH MOSAIC K99/R00 Postdoctoral Career Transition Award (Funded for \$1 Million) 2024

"An Adaptive Framework to Synthesize and Reconfigure Bacterial Viruses (Phages) to Counter Antibiotic Resistance,"

Yan Zhang (PI)

Caltech Rosen Bioengineering Center Pilot Grant (Funded for \$80k) 2024

"In Vitro Phage Synthesis for High-Throughput Engineering and Phage-Inspired Designs,"

Yan Zhang (conceived and authored the proposal), Bil Clemons (PI), Kaihang Wang (Co-PI)

Caltech Center for Environmental Microbial Interactions Pilot Grant (Funded for \$40k) 2023

"Cell-Free Systems as a Universal Platform for Phage Production."

Yan Zhang (conceived and authored the proposal), Richard M. Murray (PI)

FELLOWSHIPS, AWARDS, AND HONORS

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| ACS Chemical Abstract Services (CAS) Future Leader | 2025 |
| AIChE Women-in-Chemical Engineering (WIC) Travel Award | 2024 |
| Best Ph.D. Thesis Award, Georgia Tech Chapter of Sigma Xi | 2023 |
| Caltech Presidential Postdoctoral Fellowship | 2022 |
| MIT Rising Stars in Chemical Engineering | 2022 |
| Georgia Tech Office of the Executive Vice President for Research (EVPR) Poster Award | 2022 |
| First Place, Georgia Tech F. L. "Suddath Fellowship Award | 2022 |
| Most Dedicated Mentor Award in the 2021 iGEM Mentorship Program | 2021 |
| Georgia Tech Research Institute (GTRI) Graduate Student Fellow | 2021 |
| Georgia Tech ChBE Garry Betty Chair Fellowship | 2021 |
| Honorable Mention in NSF Graduate Research Fellowship | 2018 |
| Chi Alpha Epsilon National Honor Society Inductee | 2016 |
| Philips 66 Scholarship | 2016 |
| Ronald E. McNair Post-Baccalaureate Scholar | 2015 |

PUBLICATIONS

Journal Articles

10. Hu, C. Y., **Zhang, Y.**, Sun, Y., Lucks, J. B. (*in preparation for submission*) RNA-Overload Amplifies the Dynamic Range of Transcription Regulators. [Draft available upon request]
9. **Zhang, Y***, Deveikis, M., Qiu, Y., Björn, L., Martinez, Z. A., Chou, T., Freemont, P. S., Murray, R. M. (2025). Optimizing Protein Production in One-Pot PURE Systems: Insights into Reaction Composition and Expression Efficiency. *ACS Synth Biol*. [\[link\]](#)
*corresponding author
8. McSweeney, M. A., **Zhang, Y.**, Styczynski, M. P. (2023). Short Activators and Repressors of RNA Toehold Switches. *ACS Synth Biol*, 12(3), 681-688. [\[link\]](#)
7. Ahmed, T., **Zhang, Y.**, Lee, J.-H., Styczynski, M. P., & Takayama, S. (2022). Nucleic Acid Partitioning in PEG-Ficoll Protocells. *Journal of Chemical & Engineering Data*, 67(8), 1964-1971. [\[link\]](#)
6. **Zhang, Y.**, Steppe, P. L., Kazman, M. W., & Styczynski, M. P. (2021). Point-of-Care Analyte Quantification and Digital Readout via Lysate-Based Cell-Free Biosensors Interfaced with Personal Glucose Monitors. *ACS Synth Biol*, 10(11), 2862-2869. [\[link\]](#)
5. **Zhang, Y.**, Kojima, T., Kim, G. A., McNerney, M. P., Takayama, S., & Styczynski, M. P. (2021). Protocell Arrays for Simultaneous Detection of Diverse Analytes. *Nat Commun*, 12(1), 5724. [\[link\]](#)
4. Miguez, A. M., **Zhang, Y.**, Piorino, F. & Styczynski, M. P. (2021). Metabolic Dynamics in Escherichia coli-Based Cell-Free Systems. *ACS Synth Biol*, 10(9), 2252-2265. [\[link\]](#)
3. Byagathvalli, G., Sinha, S., **Zhang, Y.**, Styczynski, M. P., Standeven, J., & Bhamla, M. S. (2020). Electropen: an Ultra-Low-Cost, Electricity-Free, Portable Electroporator. *PLoS Biol*, 18(1), e3000589. [\[link\]](#)
2. McNerney, M. P., **Zhang, Y.**, Steppe, P., Silverman, A. D., Jewett, M. C., & Styczynski, M. P. (2019). Point-of-Care Biomarker Quantification Enabled by Sample-Specific Calibration. *Sci Adv*, 5(9), eaax4473. [\[link\]](#)
1. Hu, C. Y., Takahashi, M. K., **Zhang, Y.**, & Lucks, J. B. (2018). Engineering a Functional Small RNA Negative Autoregulation Network with Model-Guided Design. *ACS Synth Biol*, 7(6), 1507-1518. [\[link\]](#)

Book Chapters Contributed

2. **Zhang, Y.** and Hu, C. Y. Chapter 13: Spatially Organized Circuits – Background: Compartmentalization in Biology. *The Art of Molecular Programming*. Molecular Programming Society. [\[link\]](#)
1. Miguez, A. M., **Zhang, Y.**, Styczynski, M. P. (2022). Metabolomics Analysis of Cell-Free Expression Systems Using Gas Chromatography-Mass Spectrometry. In: Karim, A. S., Jewett, M. C. (eds) *Cell-Free Gene Expression: Methods and Protocols*, vol 2433. Humana, New York, NY. [\[link\]](#)

Research Roadmap Contributed

3. Engineering Biology Research Consortium (2024). *Engineering Biology for Space Health: An innovative research roadmap*. [\[link\]](#)
2. Engineering Biology Research Consortium (2023). *An Assessment of Short-Term Milestones in EBRC's 2019 Roadmap, Engineering Biology*. [\[link\]](#)
1. Engineering Biology Research Consortium (2022). *Engineering Biology for Climate & Sustainability: A Research Roadmap for a Cleaner Future*. [\[link\]](#)

PRESENTATIONS

Talks

8. "Designing the Cell-Free Gene Expression Environment" Selected abstract. **American Chemical Society (ACS) Fall Meeting**, Washington DC., August 2025. [\[slides\]](#)
7. "Optimizing Protein Production in One-Pot PURE Systems: Insights into Reaction Composition and Expression Efficiency." Selected abstract. **Build-A-Cell Weekly Seminar Series**, Virtual, April 2025. [\[video link\]](#)
6. "Optimizing Protein Production in One-Pot PURE Systems: Insights into Reaction Composition and Expression Efficiency." Selected abstract. **13th International Conference on Biomolecular Engineering**, Houston, TX, January 2025. [\[slides\]](#)
5. "Protocell Arrays for Simultaneous Detection of Diverse Analytes." Young speaker. **Synthetic Biology Young Speaker Series (SynBYSS)**, Virtual, March 2023. [\[video link\]](#)
4. "New Interfaces for Cell-free Biosensors to Enable Multiplexed Analyte Detection and Quantification at the Point of Care." Award Winner Presentation. **Suddath Symposium**, Virtual. January 2022.
3. "The Sweet Solution to Sensing: Repurposing Glucose Monitors to Detect Micronutrient Deficiency and Pathogenic Bacteria." Selected abstract. **Georgia Tech School of Chemical & Biomolecular Engineering 33rd Annual Graduate Research Symposium**, Virtual. February 2021.
2. "Multiplexed Biomarker Detection in Cell-Free System via Aqueous Two-Phase System." Department seminar. **Georgia Tech School of Chemical & Biomolecular Engineering 4th Year Colloquium**, Virtual. August 2020.
1. "Multiplexing Cell-Free Diagnostics via Aqueous Two-Phase System." Selected abstract. **Engineering Biology Research Consortium (EBRC) Annual Meeting**, Virtual. April 2020.

MENTORING EXPERIENCE

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| Caltech Summer Undergraduate Research Fellowship (SURF) | 2024- |
| <ul style="list-style-type: none"> ○ Grace Tuhabonye, Chemical Engineering, Caltech ○ Lovisa Björn, Lund University, Sweden | |
| Caltech Connection Mentoring and Outreach Program | 2022 |
| <ul style="list-style-type: none"> ○ Sheung Ho Lam, undergraduate mentee from Pasadena City College | |
| EBRC Mentorship for Undergraduate and Master Students (EMUMS) | 2022 |
| <ul style="list-style-type: none"> ○ Czarlyn Cumba, undergraduate mentee from California State University, Northridge | |
| International Genetically Engineered Machines (iGEM) Competition | 2018- |
| <ul style="list-style-type: none"> ○ Federal University of Rio de Janeiro (Brazil), over-graduate team ○ Zhejiang University of Technology, collegiate team ○ University of Maryland, collegiate team (<i>recognized with Most Dedicated Mentor Award</i>) ○ Lambert High School, high school team | |
| Undergraduate Research in Styczynski Lab, Georgia Tech | 2018- |
| <ul style="list-style-type: none"> ○ Vidhya M. Mallikarjunan, ChemE major undergraduate researcher ○ Maxwell W. Kazman, ChemE major undergraduate researcher (NSF-GRFP '23) ○ Paige L. Steppe, ChemE major undergraduate researcher (NSF-GRFP '22) ○ Niya J. Ford, ChemE major undergraduate researcher | |

TEACHING EXPERIENCE

Georgia Tech

- ChBE 3200: Transport Phenomenon I (*co-instructor for Tech-to-Teaching capstone*) 2022
- ChBE 4510: Process and Product Design and Economics (*graduate teaching assistant*) 2019
- ChBE 2120: Numerical Methods in Chemical Engineering (*graduate teaching assistant*) 2018

Cornell University

- CHEME 3320: Analysis of Separation Processes (*undergraduate teaching assistant*) 2017
- CHEME 3130: Thermodynamics (*undergraduate teaching assistant*) 2016

SERVICE AND OUTREACH

Journal Reviewer

- ACS Sensors 2023-

Undergraduate Research at Caltech

- Summer Undergraduate Research Fellowship (SURF), *Reviewer* 2024
- Summer Undergraduate Research Fellowships (SURF), *Presentation Judge* 2023

Engineering Biology Research Consortium (EBRC)

- Policy and International Engagements Working Group, *Liaison* 2024-
- Graduate Student & Postdoc Association (SPA) Board, *Vice President* 2022
- Government and Industry Mentorship Program, *Co-chair* 2021

Molecular Programming Society

- Art of Molecular Programming Grass-root Textbook Initiative, *Editor* 2022

International Genetically Engineered Machine (iGEM) Community

- iGEM Giant Jamboree, *Judge* 2020-

Undergraduate Research at Georgia Tech

- President's Undergraduate Research Award, *Reviewer* 2018

PROFESSIONAL DEVELOPMENT

- Center for the Integration of Research, Teaching, and Learning (CIRTL) Associate Level Certificate 2022
- Tech-to-Teaching Certificate in College Teaching, Georgia Tech 2022