



YAN ZHANG

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Division of Biology and Biological Engineering
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she/her/hers

RESEARCH INTEREST

My research vision is to enable Biology-by-Design - creating synthetic biological systems from the ground up with a defined purpose. My research program will initially focus on developing synthetic bacteriophages, viruses that specifically infect bacterial hosts, with applications in phage therapy against antibiotic resistance, targeted gene delivery, and precision microbial community control.

EDUCATION

2017-22	Georgia Institute of Technology Doctor of Philosophy in Chemical & Biomolecular Engineering <i>Thesis: New Interfaces to Advance Point-of-Care Biosensor Diagnostics</i>	Atlanta, GA
2013-17	Cornell University Bachelor of Science in Chemical Engineering, <i>Cum Laude</i>	Ithaca, NY

RESEARCH EXPERIENCES

2022-	Murray Lab, Division of Biology & Biological Engineering, Caltech <i>Advisor: Prof. Richard M. Murray</i> <ul style="list-style-type: none">Leverage mass spectrometry-based proteomics to characterize cell-free proteome compositionUtilize proteomics to identify sources of inter-lab variability in cell-free systems for standardization This work has resulted in a manuscript preprint on <i>BioRxiv</i> , which is pending journal submission.
2017-22	Styczynski Lab, School of Chemical & Biomolecular Engineering, Georgia Tech <i>Advisor: Prof. Mark P. Styczynski</i> <ul style="list-style-type: none">Innovated protocell arrays platform interfacing cell-free biosensors with polymer biphasic system for multiplexed analyte detectionIntegrated cell-free systems to a personal glucose monitor for field-deployable analyte quantificationCharacterized the effect of different lysate preparation methods on cell-free protein production and central metabolism This work has resulted in 7 publications in <i>Nature Communications</i> , <i>Science Advances</i> , <i>ACS Synthetic Biology</i> , <i>PLoS Biology</i> , <i>Journal of Chemical Engineering Data</i> , and 1 book chapter contribution.
2015-16	Lucks Lab, School of Chemical & Biomolecular Engineering, Cornell University <i>Advisor: Prof. Julius B. Lucks (now at Northwestern University)</i> <ul style="list-style-type: none">Simulated RNA negative autoregulation network using mass action kinetics model to predict outputPrototyped RNA networks in cell-free systems and implemented design in <i>E. coli</i> cells This work resulted in 1 third-author publication in <i>ACS Synthetic Biology</i> .

GRANT WRITING EXPERIENCES

2024	NIH R21 Exploratory/Developmental Research Grant (submitted) <ul style="list-style-type: none">"<i>In Vitro Production of Modular Bacteriophages for Targeted Gene Delivery and Therapeutic Applications</i>," Yan Zhang, William Clemons (PI), Kaihang Wang (Co-PI).
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- 2024 **Caltech Rosen Bioengineering Center Pilot Grant** (Funded for \$80,000)
- “*In Vitro Phage Synthesis for High-Throughput Engineering and Phage-Inspired Designs*,” Yan Zhang, William Clemons (PI), Kaihang Wang (Co-PI)
- 2024 **NIH MOSAIC K99/R00 Postdoctoral Career Transition Award** (NIBIB, Impact Score 20)
- “*An Adaptive Framework to Synthesize and Reconfigure Bacterial Viruses (Phages) to Counter Antibiotic Resistance*,” Yan Zhang (PI)
- 2023 **Caltech Center for Environmental Microbial Interactions Pilot Grant** (Funded for \$40,000)
- “*Cell-Free Systems as a Universal Platform for Phage Production*.” Yan Zhang, Zachary A. Martinez, Richard M. Murray (PI)

FELLOWSHIPS, AWARDS, AND HONORS

- 2023 Best Ph.D. Thesis Award, Georgia Tech Chapter of Sigma Xi
- 2022 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. “Bud” Suddath and Frances “Lee” Gafford Suddath Fellowship Award
- 2021 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
- 2018 Honorable Mention in NSF Graduate Research Fellowship
- 2016 Chi Alpha Epsilon National Honor Society Inductee
- 2016 Philips 66 Scholarship
- 2015 Ronald E. McNair Post-Baccalaureate Scholar

PUBLICATIONS

Journal Articles

9. **Zhang, Y.**, Qiu, Y., Deveikis, M., Martinez, Z. A., Chou, T., Freemont, P. S., Murray, R. M. (*pending journal submission*) Optimizing Protein Expression in One-Pot PURE Systems: Insights into Reaction Composition and Translation Efficiency. [\[link to BioRxiv preprint\]](#)
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

2. **Zhang, Y.** and Hu, C. Y. (accepted). 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 Roadmaps

3. Engineering Biology Research Consortium (drafting). 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

7. “Protocell Arrays for Simultaneous Detection of Diverse Analytes.” Guest presentation. Paul Freemont and Yuval Elani Group, Imperial College London, London, U.K., April 2023.
6. “Protocell Arrays for Simultaneous Detection of Diverse Analytes.” Young speaker. Synthetic Biology Young Speaker Series (SynBYSS), Global Virtual Seminar. March 2023. [\[video link\]](#)
5. “New Interfaces for Cell-free Biosensors to Enable Multiplexed Analyte Detection and Quantification at the Point of Care.” Invited talk. Richard Murray Group, Caltech, Pasadena, CA, March 2022.
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.

Posters

8. “Optimizing Protein Expression in One-Pot PURE systems: Insights into Reaction Composition and Translation Efficiency.” Synthetic Biology: Engineering, Evolution, and Design (SEED), Atlanta, GA. June 2024.
7. “Composition of the One-Pot PURE Reaction Environment and Its Influence on Protein Expression.” Engineering Biology Research Consortium (EBRC) Annual Meeting, Atlanta, GA. May 2024.
6. “Portable Glucose Monitor-based Field-Deployable Sensing.” Annual Georgia Tech Research Institute Independent Research and Development (IRAD) Extravaganza, Atlanta, GA. June 2022.
5. “Protocell Arrays for Simultaneous Detection of Diverse Analytes.” Synthetic Biology: Engineering, Evolution, and Design (SEED), Arlington, VA. May 2022.

4. "A Sweet Solution to Sensing: Repurposing Personal Glucose Monitors to Detect Diverse Classes of Biomarkers." Georgia Tech Career, Research, and Innovation Development Conference (CRIDC), Atlanta, GA. January 2022.
3. "Cell-Free System in Aqueous Two-Phase Enables Multiplexing of Small Molecule and Nucleic Acids." Synthetic Biology: Engineering, Evolution, and Design (SEED), New York, NY. June 2019.
2. "Cell-Free System in Aqueous Two-Phase Enables Multiplexing of Small Molecule and Nucleic Acids." Engineering Biology Research Consortium (EBRC) Spring Retreat, Boston, MA. February 2019.
1. "Engineering an RNA-based Negative Autoregulation Circuit." Synthetic Biology: Engineering, Evolution, and Design (SEED), Chicago, IL. June 2016.

MENTORING EXPERIENCE

- 2024- **Caltech Summer Undergraduate Research Fellowship (SURF)**
- Lovisa Björn, Lund University, Sweden
- 2022-23 **Caltech Connection Mentoring and Outreach Program**
- Sheung Ho Lam, undergraduate mentee from Pasadena City College
- 2022-23 **EBRC Mentorship for Undergraduate and Master Students (EMUMS)**
- Czarlyn Cumba, undergraduate mentee from California State University, Northridge
- 2018- **International Genetically Engineered Machines (iGEM) Competition**
- Federal University of Rio de Janeiro (Brazil), over-graduate team
 - Zhejiang University of Technology, collegiate team
 - University of Maryland, collegiate team (*recognized with Most Dedicated Mentor Award*)
 - Lambert High School, high school team
- 2018-22 **Undergraduate Research in Styczynski Lab**
- 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**
- 2022 • ChBE 3200: Transport Phenomenon I (*taught as co-instructor for Tech-to-Teaching capstone*)
- 2019 • ChBE 4510: Process and Product Design and Economics (*graduate teaching assistant*)
- 2018 • ChBE 2120: Numerical Methods in Chemical Engineering (*graduate teaching assistant*)
- Cornell University, Undergraduate teaching assistant**
- 2017 • CHEME 3320: Analysis of Separation Processes
- 2016 • CHEME 3130: Chemical Engineering Thermodynamics

SERVICE AND OUTREACH

- 2023- **Journal Reviewer**
- ACS Sensors
- Undergraduate Research at Caltech**
- 2024 • Summer Undergraduate Research Fellowship (SURF), *Reviewer*
- 2023 • Summer Undergraduate Research Fellowships (SURF) Seminar Day, *Presentation Judge*
- 2022- **Molecular Programming Society**
- Art of Molecular Programming Grass-root Textbook Initiative, *Editor*

Engineering Biology Research Consortium (EBRC)

- 2024-
 - Policy and International Engagements Working Group, *Liaison*
- 2022-24
 - Graduate Student & Postdoc Association (SPA) Board, *Vice President*
- 2021-24
 - Government and Industry Mentorship Program, *Co-chair*
- 2021-23
 - Undergraduate Societies Outreach Initiative, *Co-lead*
 - Writing Effective Statement of Purpose for Graduate School, *Panelist*
 - Applying to Graduate Fellowships Virtual Workshop, *Panelist*
 - Research Roadmap, *Contributor*
- 2020-

International Genetically Engineered Machine (iGEM) Community

 - iGEM Giant Jamboree, *Judge*
- 2018-22

Undergraduate Research at Georgia Tech

 - President's Undergraduate Research Award, *Reviewer*

PROFESSIONAL DEVELOPMENT

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| 2022 | Center for the Integration of Research, Teaching, and Learning (CIRTL) Associate Level Certificate |
| 2022 | Tech-to-Teaching Certificate in College Teaching, Georgia Tech |
| 2021 | Mentorship for the Professoriate Program in Georgia Tech School of Chemical & Biomolecular Engineering |