David C. Garcia, Ph.D

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Research Experience

California Institute of Technology, Pasadena, California, March 2024-Present

Division of Biology and Biological Engineering - Murray Lab – Senior Research Scientist

Senior research scientist working the Army's DEVCOM CBC lab and housed at Caltech. Research work focuses on the use of large language models and data-driven techniques to enable high-throughput biological catalyst optimization and biomaterials production.

DEVCOM Chemical Biological Center, Edgewood, Maryland, Dec 2021-March 2024

Biochemistry Division - Lux Lab - National Research Council Postdoctoral Fellow

As part of the congressionally funded Cell-Free Biomanufacturing Institute, I was responsible for leading and being part of teams developing high-throughput testing platforms designed to improve scaled cell-free biosensing and cell-free metabolic engineering systems.

California Institute of Technology, Pasadena, California, March 2020-Dec 2021

Division of Biology and Biological Engineering - Murray Lab - National Research Council Postdoctoral Fellow

Development and use of computational and experimental tools to produce biocircuitry for non-canonical cell-free systems.

Oak Ridge National Laboratory, Oak Ridge, Tennessee, June 2015 – March 2020

Biosciences Division - Doktycz Lab - National Science Foundation Graduate Research Fellow

Thesis work was focused on developing cell-free systems optimized for cell-free metabolic engineering and protein production as a tool for biological discovery and biological production.

Education

The University of Tennessee, Knoxville Knoxville, TN 2015-2020
Ph.D. in Energy Science and Engineering,
Thesis: *Cell-Free Enabled Bioproduction and Biological Discovery*
Advisor: Dr. Mitchel J. Doktycz

Ripon College Ripon, WI 2010-2014
B.A. Chemistry; Majors: Chemistry, History; Minors: Economics
Thesis: *Isolation and Expression of JT-5 Isolate Glycohydrolytic Enzymes*

Fellowships, Awards, and Grants

2024-Present	**Grant:** Co-PI with Marilyn Lee: DoD Tri-Service Biotechnology for a Resilient Supply Chain (T-BRSC) (**$300K**)
2023-Present:	**Grant:** Principal Investigator: Chemical Biological Advanced Materials and Manufacturing Science (**$750K**)
2022-Present:	**Grant:** Principal Investigator: DEVCOM CBC Laboratory Independent Research Program (**$405K**)
2021-2024:	**Fellowship:** National Research Council Postdoctoral Fellowship
2020:	**Award:** ORNL (Biosciences Division) Distinguished Achievement Award
2020:	**Award:** UT Extraordinary Professional Promise Award
2017-2020:	**Fellowship,** National Science Foundation Graduate Research Fellowship
2017:	**Award:** Forum on Science Ethics and Policy Writing Competition 1st Place
2016:	**Award**, GEM Consortium Conference 2016: 1st Place Poster Award
2016:	**Award**, 2016 National Science Foundation Conference Travel Grant
2015-16:	**Fellowship,** Energy Science & Engineering, Bredesen Center for Interdisciplinary Research and Graduate Education Fellowship, University of Tennessee
2015-16:	**Fellowship,** GEM Consortium Graduate Fellowship

Publications

Research Manuscripts:

- Dylan M. Brown, Daniel A. Phillips, **David C. Garcia,** et al. 2024. "Semi-Automated Production of Cell-Free Biosensors." bioRxiv, 2024.10.13.618078.
- **David C. Garcia**, John P. Davies, Charles E. Davidson, Daniel A. Phillips, Aleksandr E. Miklos, and Matthew M. Lux. 2024. “High-Throughput Optimization of Paper-Based Cell-Free Biosensors.” *bioRxiv*, 2024.10. 03.616554.
- **David C. Garcia**, John P. Davies, Katherine Rhea, Marilyn Slininger Lee, and Matthew W. Lux. 2023. “Cell-Free Optimized Production of Protoporphyrin IX.” *bioRxiv*, 2023.12. 28.573540.
- Alissa Bleem, Eugene Kuatsjah, Gerald N. Presley, Daniel J. Hinchen, Michael Zahn, **David C. Garcia**, William E. Michener, Gerhard König, Konstantinos Tornesakis, and Marco N. Allemann. 2022. “Discovery, Characterization, and Metabolic Engineering of Rieske Non-Heme Iron Monooxygenases for Guaiacol O-Demethylation.” *Chem Catalysis* 2 (8): 1989–2011.
- John B. McManus, Casey B. Bernhards, Caitlin E. Sharpes, **David C. Garcia**, Stephanie D. Cole, Richard M. Murray, Peter A. Emanuel, and Matthew W. Lux. 2021. “Rapid Characterization of Genetic Parts with Cell-Free Systems.” *JoVE (Journal of Visualized Experiments)*, no. 174, e62816.
- **David C. Garcia**, Jaime Lorenzo N. Dinglasan, Him Shrestha, Paul E. Abraham, Robert L. Hettich, and Mitchel J. Doktycz. 2021. “A Lysate Proteome Engineering Strategy for Enhancing Cell-Free Metabolite Production.” *Metabolic Engineering Communications* 12.
- Presley, Gerald N., Allison Z. Werner, Rui Katahira, **David C. Garcia**, Stefan J. Haugen, Kelsey J. Ramirez, Richard J. Giannone, Gregg T. Beckham, and Joshua K. Michener. 2021. “Pathway Discovery and Engineering for Cleavage of a β-1 Lignin-Derived Biaryl Compound.” *Metabolic Engineering* 65:1–10.
- **David C. Garcia**, Xiaolin Cheng, Miriam L. Land, Robert F. Standaert, Jennifer L. Morrell-Falvey, and Mitchel J. Doktycz. 2019. “Computationally Guided Discovery and Experimental Validation of Indole-3-Acetic Acid Synthesis Pathways.” *ACS Chemical Biology* 14 (12): 2867–75.
- Cecil, Jacob H., **David C. Garcia**, Richard J. Giannone, and Joshua K. Michener. 2018. “Rapid, Parallel Identification of Catabolism Pathways of Lignin-Derived Aromatic Compounds in Novosphingobium Aromaticivorans.” *Applied and Environmental Microbiology* 84 (22): e01185-18.
- **David C. Garcia**, Benjamin P. Mohr, Jakob T. Dovgan, Gregory B. Hurst, Robert F. Standaert, and Mitchel J. Doktycz. 2018. “Elucidating the Potential of Crude Cell Extracts for Producing Pyruvate from Glucose.” *Synthetic Biology* 3 (1): ysy006.
- Estenson, Kasey, Gregory B. Hurst, Robert F. Standaert, Amber N. Bible, **David Garcia**, Karuna Chourey, Mitchel J. Doktycz, and Jennifer L. Morrell-Falvey. 2018. “Characterization of Indole-3-Acetic Acid Biosynthesis and the Effects of This Phytohormone on the Proteome of the Plant-Associated Microbe Pantoea Sp. YR343.” *Journal of Proteome Research* 17 (4): 1361–74.
- Rydzak, Thomas, **David Garcia**, David M. Stevenson, Margaret Sladek, Dawn M. Klingeman, Evert K. Holwerda, Daniel Amador-Noguez, Steven D. Brown, and Adam M. Guss. 2017. “Deletion of Type I Glutamine Synthetase Deregulates Nitrogen Metabolism and Increases Ethanol Production in Clostridium Thermocellum.” *Metabolic Engineering* 41:182–91.

Selected Conference Proceeding and Invited Talks:

- **Garcia, D.C.**; Murray, R.; Computationally Guided Approaches to Produce Biological Polymers. AIChE Annual Meeting. (2024) (**Talk**)
- **Garcia, D.C**.; Davies, J.P.; Phillips, D.; Miklos, A.; Lux, M.; High-Throughput Optimization of Paper-Based Cell-Free Biosensors. *2nd Cell-Free Systems Conference*. (2023) (**Talk**)
- **Garcia, D.C**.; Davies, J.P.; Lee, M.; Lux, M. Cell-Free Optimized Production of Protoporphyrins. *2023 DoD Biotechnology for Defense (B4D) Symposium*. (2023) (**Invited Talk**).
- **Garcia, D.C**.; Davies, J.P.; Phillips, D.; Miklos, A.; Lux, M.; High-Throughput Optimization of Paper-Based Cell-Free Biosensors. *Synthetic Biology Young Speaker Series*. (2023) (**Talk**)
- **Garcia, D.C.,** Davies, J, Lux, M. High-Throughput Optimization of Cell-Free Systems. *Northwestern University Seminar*. (2023) (**Invited Talk**).

- **Garcia, D.C**., Davies, J, Lux, M. Cell-Free Prototyping and Rapid Optimization of Paper-Based Biological Sensors. American Chemical Society Meeting. (2022) (**Invited Talk**).
- **Garcia, D.C**., Dinglasan, E, Doktycz, M. A Systems and Synthetic Biology Approach to Engineering Cell-Free Metabolism. *Gordon Res. Conf.* (2019).(**Poster**)
- **Garcia, D.C**., Cheng, X., Land, M., Doktycz, M. Elucidating Metabolic Networks through Computationally Predicted Cell-Free Metabolic Engineering. *PSNA Annual Conference.* (2019) (**Invited Talk**).
- **Garcia, D.C**., Cheng, X., Land, M., Doktycz, M. Elucidating Metabolic Networks through Computationally Predicted Cell-Free Metabolic Engineering. *Gordon Res. Conf.* (2017). (**Poster**)

Invention Disclosures and Patents:

- Doktycz, Mitchel J; Dinglasan, Jaime Lorenzo N; Garcia, David; Mohr, Ben P; "Cell-free metabolic pathway optimization through removal of select proteins 2021,"US Patent App. 17/235,450"
- Cecil, J. H.; Garcia, D. C.; Giannone, R. J.; Michener, J. K. Enzymatic Pathway for Conversion of a Model Lignin Linkage. UTRF Invention Disclosure *Number: 20014-03.* (2019).
- Cecil, J. H.; Garcia, D. C.; Giannone, R. J.; Michener, J. K. Identification of a Novel Guaiacol Demethylase for Lignin Valorization. UTRF Invention Disclosure *Number: 20013-03.* (2019).

Outreach, Service, and Mentoring

- **Engineering Biology Research Consortium Fellowships Mentor**: Participated in panels advising students applying to NSF GRFP and reviewed and edited application material (2024)
- **Caltech DIVE (Diversification Initiative through Veteran Education) Mentor:** Served as research mentor guiding student veterans through independent research projects. (2024)
- **Caltech SURF (Summer Undergraduate Research) Mentor:** Mentor for visiting undergraduate research students performing independent research in the Murray Lab. (2022 & 2024)
- **Invited Manuscript Reviewer:** *ACS Synthetic Biology, Biotechnology Advances*
- **NIST Workshop on Advancing Cell-Free Manufacturing: Challenges in Scale-up and Automation:** Participated in workshop to identify challenges to achieving reproducible cell-free expression at commercial scales. (2024)
- **Synthetic Biology Young Speaker Series Conference Organizing Committee:** Assisting with organizing and funding the first iteration of the international Synthetic Biology Young Speaker Series conference. (2023-Present)
- **Synthetic Biology Gordon Research Seminar Elected Chair**: Responsible for funding and organizing Gordon research seminar and international conference . (2019-2023)
- **IGEM Graduate Student Mentor and Founder**: Organized and mentored an undergraduate team of researchers to design, perform, and present at the International Genetically Engineered Machine competition. (2015-2018)
- **IGEM Giant Jamboree Judge**: Judged student presentations and posters at IGEM conference (2017).
- **University of Tennessee Knoxville Undergraduate Mentor**: Mentored multiple students at various stages of their careers apply to graduate school, for fellowships, or undergraduate research positions. (2015-2020)