Theo Gibbs

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Professional Appointments

2025 - | **Schmidt Science Fellow and Postdoctoral Researcher, New York University**
Adviser: Joy Bergelson

2021-2025 | **NSF Graduate Research Fellow in Ecology, Princeton University**

2018-2019 | **Research Assistant, University of Illinois at Urbana-Champaign**
Adviser: James O'Dwyer

Education

2019-2025 | **PhD in Quantitative and Computational Biology, Princeton University**
Advisers: Jonathan Levine and Simon Levin
Thesis: *Higher-order interactions and species coexistence in diverse ecological communities*

2019-2021 | **MA in Quantitative and Computational Biology, Princeton University**
Advisers: Jonathan Levine and Simon Levin

2014-2018 | **BS in Mathematics with Honors, University of Chicago**
Adviser: Stefano Allesina

Research Interests

My research combines theory and experiment to understand how diverse ecological communities stably coexist. I am especially interested in interactions that uniquely emerge in diverse communities, often called higher-order interactions. I conduct experiments with annual plants in the field and microbial strains in the lab. In parallel, I build and analyze theoretical models for how species interactions impact diverse coexistence.

Publications

Preprints and In Preparation

- Adler, P., Detto, M., Ellner, S., **Gibbs, T.**, Gold, Z., Leonard, S., Levine, J., Schiffer, A., Song, C., Stemkovski, M., Vahsen, M. & Levine, J. Empirical applications of modern coexistence theory: missed opportunities, unexpected progress, and recommendations.
- **Gibbs, T.***, Mazzarisi, O.*, Fant, L., An, R., Grilli, J., Barabás, G. † & Song, C.† Label invariance: a guiding principle for ecological models. *In Prep*. (* and † denote equal contribution).
- **Gibbs, T.***, Gold, Z.*, Oyler, H., Levine, J., Kraft, N. Spatial clustering reveals the impact of higher-order interactions in a diverse annual plant community. *bioRxiv*. In review at *PNAS*. (* denotes equal contribution).
- **Gibbs, T.**, Dahlin, K., Brennan, J., Silveira, C.*, McManus, L.* Coexistence of bacteria with a competition-colonization tradeoff on a dynamic coral host. *bioRxiv*. In review at *Ecology*. (2024). (* denotes equal contribution).

Published

8. **Gibbs, T.**, Levine, J. & Turcotte, M. Competitor-induced plasticity modifies the interactions and predicted competitive outcomes between annual plants. *Ecology* (2025).
7. **Gibbs, T.**, Gellner, G., Levin, S., McCann, K., Hastings, A. & Levine, J. When can higher-order interactions produce stable coexistence? *Ecology Letters* (2024).
6. **Gibbs, T.**, Levin, S. & Levine, J. Coexistence in diverse communities with higher-order interactions. *Proceedings of the National Academy of Sciences* (2022). **Honorable mention for the Outstanding Ecological Theory Paper Award from the Ecological Society of America.**
5. **Gibbs, T.**, Zhang, Y., Miller, Z. & O'Dwyer, J. Stability criteria for the consumption and exchange of essential resources. *PLoS Computational Biology* (2022).

4. Yamamichi, M., **Gibbs, T.**, & Levine, J. Integrating eco-evolutionary dynamics and modern coexistence theory. *Ecology Letters* (2022).

3. Levine, J., Levine, J., **Gibbs, T.** & Pacala, S. Competition for water and species coexistence in phenologically structured annual plant communities. *Ecology Letters* (2022).

2. D'Andrea, R.*, **Gibbs, T.*** & O'Dwyer, J. Emergent neutrality in consumer-resource dynamics. *PLoS Computational Biology* (2020). (* denotes equal contribution).

1. **Gibbs, T.**, Grilli, J., Rogers, T., & Allesina, S. Effect of population abundances on the stability of large random ecosystems. *Physical Review E* (2018).

Grants, Honors and Awards

2025 | Schmidt Science Fellow for Interdisciplinary Postdoctoral Research – $220,000

2025 | NSF Postdoctoral Fellowship: PRFB – $270,000 (declined)

2025 | Life Sciences Research Foundation (LSRF) Fellowship Finalist – $231,000 (declined)

2023 | Cassidy Yang Memorial Prize for excellence in academics and leadership in outreach from the Lewis-Sigler Institute at Princeton University – $1,500

2023 | Honorable Mention for the 2023 ESA Outstanding Ecological Theory Paper Award

2023 | Mary and Randall Hack '69 Graduate Award for Water and the Environment from Princeton University – $8,000

2023 | Sole Departmental Nominee for Honorific Fellowship from Princeton University

2021 | NSF Graduate Research Fellow in Ecology – $138,000

2020 | AAAS Program for Excellence in Science Awardee

2019 | Institute Scholars Award in Quantitative and Computational Biology for first-year graduate students at Princeton University – $8,000

2018 | Honors in Mathematics at the University of Chicago

2018 | General Honors at the University of Chicago

2018 | The Dean's List Every Quarter at the University of Chicago

2018 | Fulbright US Student Research Award Semifinalist

Workshops, Talks and Seminars

Invited Workshops

→ Banff International Research Station, New Mathematical Theory in Eco-Evolutionary Modelling of Host-Symbiont Communities, February 8-13, 2026. Banff, Canada.

→ Istituto Veneto di Scienze, Lettere ed Arti, Alma Dal Co School on Collective Behavior, September 29 - October 4, 2025. Venice, Italy.

→ Hawaii Institute of Marine Biology, Theory of Microbial Symbiosis Workshop, February 26 - March 15, 2024. Kaneohe, USA.

Invited Talks

→ Sun Yat-Sen University, Group of Professor Yuanzhi Li, December 17, 2024. Guanzhou, China.

→ New York University, Group of Professor Mingzhen Lu, November 13, 2024. New York City, USA.

→ Princeton University, Graduate Student Seminar for the Program in Applied and Computational Mathematics, April 22, 2024. Princeton, USA.

→ Hawaii Institute of Marine Biology, Theory of Microbial Symbiosis Workshop, March 4, 2024. Kaneohe, USA.

→ The College of New Jersey, Colloquium in the Department of Mathematics and Statistics, November 28, 2023. Ewing, USA.

→ RIKEN Interdisciplinary Theoretical and Mathematical Sciences Program, Biology Seminar, October 9, 2023. Saitama Prefecture, Japan.

→ International Congress on Industrial and Applied Mathematics, "Hypernetworks and their dynamics in theory and applications" Minisymposium, August 24, 2023. Tokyo, Japan.

→ SUNY Stony Brook, Group of Professor Rafael D'Andrea, July 18, 2022. Stony Brook, USA.

Contributed Talks

→ Ecological Society of America, Contributed talk in the Modeling: Populations section, August 13, 2025. Baltimore, USA.

→ Princeton University, Theoretical Ecology Lab Tea, October 30, 2024. Princeton, USA.

→ Ecological Society of America, Contributed talk in the Competition section, August 6, 2024. Long Beach, USA.

→ Ecological Society of America, Contributed talk in the Modeling: Communities, Disturbance, Succession section, August 9, 2023. Portland, USA.

→ Princeton University, Theoretical Ecology Lab Tea, April 19, 2023. Princeton, USA.

→ Princeton University, QCB Graduate Student Colloquium, April 12, 2023. Princeton, USA.

→ American Physical Society March Meeting, Contributed Talk to the Ecological Dynamics session, March 7, 2023. Las Vegas, USA.

→ British Ecological Society, Contributed talk in the Theoretical and Computational Ecology section, December 19, 2022. Edinburgh, Scotland.

→ Ecological Society of America and Canadian Society for Ecology and Evolution Joint Meeting, Contributed talk in the Modeling section, August 16, 2022. Montreal, Canada.

→ Seminar at Theoretical Ecology Lab Tea at Princeton University, March 30, 2022. Princeton, USA.

→ American Physical Society March Meeting,Contributed Talk to the Ecological and Evolutionary Dynamics session, March 16, 2022. Chicago, USA.

→ Princeton University, QCB Graduate Student Colloquium, March 2, 2022. Princeton, USA.

→ Princeton University, Theoretical Ecology Lab Tea, October 6, 2021. Princeton, USA.

→ Princeton University, QCB Graduate Student Colloquium, April 7, 2021. Princeton, USA.

→ Princeton University, Theoretical Ecology Lab Tea, June 24, 2020. Princeton, USA.

→ University of Tokyo, Towards an Integration of Diverse Concepts in Community Ecology Workshop, October 5th, 2019. Tokyo, Japan.

→ NetSci 2018, Contributed Talk in the Ecology Session, June 13 - 15, 2018. Paris, France.

→ Chicago Area Undergraduate Research Symposium 2018, April 15, 2018. Chicago, USA.

→ Chicago Midstates Research Symposium in Physical Sciences, November 3-4, 2017. Chicago, USA.

→ UChicago Undergraduate Research Symposium, October 6, 2017. Chicago, USA.

Outreach and Service

2023-2025 | **Graduate Student Representative on the QCB Climate Committee, Princeton University**
Met regularly with administrators, postdocs and faculty to improve the climate in QCB

2022-2025 | **Instructor for the Plant Ecology Field Workshop, Princeton University**
Brought local community college and Princeton students on a field work trip to a marsh ecosystem

2021-2024 | **QCB Peer Mentor, Princeton University**
Co-organized and participated in a mentoring program for beginning graduate students

2020-2025 | **Access, Diversity and Inclusion Outreach Student Ambassador, Princeton University**
Recruited students from under-represented backgrounds with the ADI team at Princeton

2020-2025 | **QCB Virtual Open House, Princeton University**
Organized the first (and now annual) virtual QCB open house to recruit applicants from non-traditional and under-represented backgrounds

2023-2024 | **Ecology and Evolutionary Biology (EEB) Mentor, Princeton University**
Mentor for under-represented students who are interested in graduate school in EEB

2021 | **Theoretical Ecology Lab Tea Organizer, Princeton University**

2020-2021 | **Princeton Online Tutoring Network, Princeton University**
Provided free tutoring assistance to under-served K-12 students in the local community

Mentoring and Teaching Experience

Teaching Assisantships

2023: Mathematical Methods in Biology and Medicine with Professor Corina Tarnita.
2022: Theoretical Ecology with Professor Simon Levin.
2016-2017: Tutored university undergraduate students in any math class.
2015-2016: Calculus I-III-III.

Graduate Students

Jiayu Zhang (2023-2024) on sparse higher-order interactions.

Undergraduate Students

Noah Egan (2023-2024) and Krishna Girish (2022-2023) on spatial higher-order interactions. Yifan Zhang (2020-2022) on microbial theory which produced a co-authored paper.

Reviewer

PNAS, PloS Computational Biology, Communications Biology, American Naturalist, Physical Review E, Scientific Reports, Ecology Letters, Theoretical Ecology, Physical Review X.

Technical Skills

- Programming in R, Python, C, LaTeX & Git
- Bayesian statistical analysis
- Statistical physics theory applied to ecology
- Dynamical systems and stochastic processes
- Field experiments with annual plants
- Analyzing microbial sequence data