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 Manuscripts in Review

- 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. In review at *Ecology Letters*.
- **Gibbs, T.***, Mazzarisi, O.*, Fant, L., An, R., Grilli, J., Barabás, G. † & Song, C.† Label invariance: a guiding principle for ecological models. *bioRxiv*. In review at *PNAS*. (* 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 *Theoretical 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	Princeton University Ecology and Evolutionary Biology Service Award to the Levine Lab for the Plant Ecology Field Workshop
2025	Banff International Research Station Pacific Institute of Mathematical Sciences Simons Travel Award – $986
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
2021	NSF Graduate Research Fellow in Ecology – $138,000
2019	Institute Scholars Award in Quantitative and Computational Biology for first-year graduate students at Princeton University – $8,000
2018	General Honors and Honors in Mathematics at the University of Chicago

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. Zachary Gold (2024-2025) on experimental measurements of 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