Kyle J. Card, Ph.D.

HHMI Hanna H. Gray Postdoctoral Fellow

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EDUCATION AND TRAINING

2020 – Present	**Postdoctoral Research Fellow** Cleveland Clinic Research | Department of Genomic Sciences and Systems Biology | Advisor: Dr. Jacob Scott
2014 – 2020	**Ph.D.** in **Microbiology & Molecular Genetics** and **Ecology, Evolutionary Biology & Behavior** Michigan State University | Department of Microbiology & Molecular Genetics | Dissertation Title: The Effects of Genetic Background on the Evolution of Antibiotic Resistance and Its Fitness Costs | Advisor: Dr. Richard Lenski
2011 – 2013	**B.S.** with Honors in **Microbiology** Michigan State University

ADDITIONAL RESEARCH EXPERIENCE

2012 – 2014	**Undergraduate and Postbaccalaureate Research** Michigan State University | Department of Microbiology & Molecular Genetics | Advisor: Dr. Frank Dazzo

PEER-REVIEWED PUBLICATIONS

Total Citations: 582
h-index: 8 (Google Scholar, as of July 13, 2026)

1. **Card K.J.***, Crozier D.*, Durmaz A., Gray J., Creary J., Stocks A., Maltas J., Bonomo R.A., Burke Z.D.C., Scott J.G. Evolution under vancomycin selection drives divergent collateral sensitivity patterns in *Staphylococcus aureus*. *Proceedings of the National Academy of Sciences* **122**, e2507962122 (2025). https://doi.org/10.1073/pnas.2507962122

2. Gopalakrishnan V.*, Crozier D.*, **Card K.J.***, Krishnan N.P., McClure E., Pelesko J., Williamson D.F.K., Webster N., Nichol D., Mandal S., Bonomo R.A., Scott J.G. Science Forum: A low-cost, open-source evolutionary bioreactor and its educational use. *eLife* **11**, e83067 (2022). https://doi.org/10.7554/eLife.83067

3. Jordan J.A., Lenski R.E., **Card K.J.** Idiosyncratic fitness costs of ampicillin-resistant mutants derived from a long-term experiment with *Escherichia coli*. *Antibiotics* **11**, 347 (2022). https://doi.org/10.3390/antibiotics11030347

4. Weaver D.T., McElvany B.D., Gopalakrishnan V., **Card K.J.**, Crozier D., Dhawan A., Dinh M.N., Dolson E., Farrokhian N., Hitomi M., Ho E., Jagdish T., King E.S., Cadnum J.F., Donskey C.J., Krishnan N., Kuzmin G., Li J., Maltas J., Mo J., Pelesko J., Scarborough J.A., Sedor G., Tian E., An G.C., Diehl S., Scott J.G. UV decontamination of personal protective equipment with idle laboratory biosafety cabinets during the COVID-19 pandemic. *PLoS One* **16**, e0241734 (2021). https://doi.org/10.1371/journal.pone.0241734

5. **Card K.J.**, Jordan J.A., Lenski R.E. Idiosyncratic variation in the fitness costs of tetracycline-resistance mutations in *Escherichia coli*. *Evolution* **75**, 1230–1238 (2021). https://doi.org/10.1111/evo.14203

6. **Card K.J.**, Thomas M., Graves J.L., Barrick J.E., Lenski R.E. Genomic evolution of antibiotic resistance is contingent on genetic background following a long-term experiment with *Escherichia coli*. *Proceedings of the National Academy of Sciences* **118**, e2016886118 (2021). https://doi.org/10.1073/pnas.2016886118

7. **Card K.J.**, LaBar T., Gomez J.B., Lenski R.E. Historical contingency in the evolution of antibiotic resistance after decades of relaxed selection. *PLoS Biology* **17**, e3000397 (2019). https://doi.org/10.1371/journal.pbio.3000397

8. Lenski R.E., Wiser M.J., Blount Z.D., Nahum J.R., Morris J.J., Zaman L., Turner C.B., Wade B.D., Maddamsetti R., Burmeister A.R., Baird E.J., Bundy J., Grant N.A., **Card K.J.**, Rowles M., Weatherspoon K., Papoulis S.E., Sullivan R., Clark C., Mulka J.S., Hajela N. Sustained fitness gains and variability in fitness trajectories in the long-term evolution experiment with *Escherichia coli*. *Proceedings of the Royal Society London B* **282**, 20152292 (2015). https://doi.org/10.1098/rspb.2015.2292

9. Ji Z., **Card K.J.**, Dazzo F.B. CMEIAS JFrad: A digital computing tool to discriminate the fractal geometry of landscape architectures and spatial patterns of individual cells in microbial biofilms. *Microbial Ecology* **69**, 710–720 (2015). https://doi.org/10.1007/s00248-014-0495-1

First/Co-first author Senior author * Equal contribution Direct mentees

FELLOWSHIPS, GRANTS, AND AWARDS

2021 – Present	**Hanna H. Gray Fellowship** Howard Hughes Medical Institute (HHMI) | Postdoctoral award phase: $514,000 in salary and research support | Faculty award phase: **$1.48 million in direct research support** and **$280,000 in indirect costs** over four years | HHMI will provide four years of **complete funding, covering salary and benefits**, to Gilliam Fellows who decide to pursue a postdoctoral position in my lab.
2020 – 2021	**Diversity Supplement** National Cancer Institute (NIH/NCI)
2020	**Ralph Evans Award** Department of Microbiology & Molecular Genetics | Michigan State University

2019 – 2020	**BEACON Center Grant** National Science Foundation (NSF) | Lenski R.E., Grant N.A., **Card K.J.**, Bundy J. BEACON's Legacy of Research and Diversity in the Long-Term Evolution Experiment | Funded: **$89,999**
2019	**Russell B. DuVall Scholar Award** Department of Microbiology & Molecular Genetics | Michigan State University
2018 – 2019	**BEACON Center Grant** National Science Foundation (NSF) | Grant N.A., **Card K.J.**, Lenski R.E., Thomas M., Graves J.L. Correlated Responses in Metabolism and Antibiotic Resistance in the LTEE. | Funded: **$94,583**
2017 – 2020	**Gilliam Fellowship for Advanced Study** Howard Hughes Medical Institute (HHMI) | **$138,000**
2017	**Rudolf Hugh Scholarship Award** Department of Microbiology & Molecular Genetics | Michigan State University
2016 – 2017	**BEACON Center Grant** National Science Foundation (NSF) | Connelly B., **Card K.J.**, Kerr B., Lenski R.E., Zaman L. An Empirical Test of the Evolution of Cooperation by the Hankshaw Effect | Funded: **$79,791**
2013	**William S. Sayer Award** Department of Microbiology & Molecular Genetics | Michigan State University

CONTRIBUTED PRESENTATIONS

2026	Evolution Conference | Selected Talk
2026	HHMI Investigator Meeting | Poster
2026	Vaughn Cooper Lab Seminar | University of Pittsburgh | **Invited Talk**
2025	Department of Biology Seminar | Case Western Reserve University | **Invited Talk**
2025	HHMI Investigator Meeting | Poster
2024	HHMI Investigator Meeting | Poster
2023	Microbial Population Biology Gordon Research Conference | Poster
2023	HHMI Investigator Meeting | Poster
2022	Meetings in Ecology and Evolution: Evolutionary Dynamics and Processes | Poster
2022	Ecology and Evolution Graduate Program Seminar | University of Pittsburgh | **Invited Talk**

2022	HHMI Investigator Meeting: Microbes and the Host Response | Poster
2021	BEACON Congress | Michigan State University | Selected Talk
2021	Case Comprehensive Center Annual Scientific Retreat | Poster
2021	Evolution Conference | Selected Talk
2021	Club Evolutionary Medicine Seminar Series | Duke University | **Invited Talk**
2019	Ecology and Evolutionary Biology (EEB) Department Seminar | University of Michigan | **Invited Talk**
2019	Microbial Population Biology Gordon Research Seminar | Selected Talk
2019	Microbial Population Biology Gordon Research Conference | Poster
2019	Molecular Mechanisms in Evolution Gordon Research Seminar | Selected Talk
2019	Molecular Mechanisms in Evolution Gordon Research Conference | Poster
2019	Ecology, Evolutionary Biology, and Behavior (EEBB) Colloquium Seminar | Selected Talk
2018	BEACON NSF Site Visit | Poster
2018	Gilliam Annual Fellows Meeting | Poster
2018	BEACON Congress | Selected Talk
2018	Population, Evolution, and Quantitative Genetics Conference | Poster
2018	Midwest Ecology and Evolution Conference | Selected Talk
2017	BEACON NSF Site Visit | Michigan State University | **Invited Talk**
2017	Gilliam Annual Fellows Meeting | Poster
2017	Ecology, Evolutionary Biology, and Behavior (EEBB) Colloquium Seminar | Selected Talk
2017	Midwest Ecology and Evolution Conference | Selected Talk
2015	BEACON Congress | Poster
2013	University Undergraduate Research and Arts Forum | Poster

TEACHING EXPERIENCE

2022	Guest Lecturer – Genes, Evolution, and Ecology | CWRU Dr. Arvid Ågren invited me to guest lecture on experimental evolution for his freshman-level biology course, “Genes, Evolution, and Ecology." I discussed how experimental evolution emerged contemporaneously with Darwin as a direct challenge to gradualism and a complementary approach to the comparative method. I also introduced the *E. coli* Long-Term Evolution Experiment to the students and highlighted several key studies. Lastly, I presented on contingency, first in the context of human history and then its implications in the evolution of drug resistance.
2016	Teaching Assistant – Fundamentals of Microbiology | MSU
2015	Teaching Assistant – Advanced Microbiology Laboratory | MSU

MENTORSHIP

2026 – Present	Drew Sager | Undergraduate | Notre Dame University
2026 – Present	Brandon Kakuda | Undergraduate | CWRU
2025 – Present	Aryan Agarwal | High School Student
2025 – Present	Rohan Desai | Undergraduate | Vanderbilt University
2025 – Present	Shiva Ayyar | Undergraduate | CWRU
2024 – Present	Justin Creary* | Postbaccalaureate | Cleveland Clinic
2024 – Present	Amira Stocks* | Undergraduate | CWRU
2022 – 2023	Donovan Wu | Undergraduate | CWRU
2022	Ashwin Balakrishnan | High School Student | Hawken Upper School
2021 – 2023	Dena Crozier* | Medical Student | CWRU
2019 – 2022	Jalin Jordan* | Undergraduate | MSU
2016 – 2017	Thomas LaBar* | Doctoral Student | MSU
2016 – 2019	Jasper Gomez* | Undergraduate | MSU
2015	Tanush Jagdish | Undergraduate | Kalamazoo College
2015	Lucas Warner | Undergraduate | MSU
2014	Jacob Wright | Undergraduate | MSU

* Led to co-authored paper(s)

PROFESSIONAL DEVELOPMENT

2018 – 2019	Internship at the Michigan Department of Health and Human Services | Infectious Disease Division
2017 – 2020	Broadening Experiences in Scientific Training (BEST) Trainee

SERVICE AND OUTREACH

Journal Peer Review: *The American Naturalist*; *Ecology and Evolution*; *eLife*; *Evolution, Medicine, and Public Health*; *G3; mSphere*; *mSystems*; *Nature Communications*; *Nature Microbiology*; *npj Antimicrobials and Resistance*; *PLoS Computational Biology; PLoS Pathogens*; *PNAS*; *Science Advances*; *Scientific Reports*

Ad-hoc Review: NSF BEACON Center; Swiss National Science Foundation; UK Research and Innovation

2026 – Present	**Rare Neurological Disorder Foundation (RNDF) Advisory Board Member** | As a member of the Clinical & Neuroscience Council, I provide strategic insights, sector expertise, and governance guidance during RNDF's redevelopment and national expansion. We advise on organizational structure, program development, fellowship curriculum refinement, national partnership strategy, governance standards, and ethical oversight.
2023 – Present	**Scientific Officer for Rise Up: Northeast Ohio** | I evaluate proposals from high school students and develop experiments for in-class research projects.
2021	**Experimental Evolution Session Chair and Moderator** | Evolution Conference
2019 – 2020	**Diversity, Equity, and Inclusion Task Force Member** | American Society for Microbiology (ASM) | I was a member of a blue-ribbon Task Force charged with elevating and embodying inclusive diversity and equity within the ASM. To this end, we comprehensively reviewed current policies and procedures to identify deficiencies within the Society that hinder DEI efforts; contracted and worked with a third-party DEI consultant – the Kaleidoscope Group – to develop a Member Perception Survey; and advanced guiding principles and vision statements to direct future work and activities, along with codifying benchmarks for success. We reported our findings and recommendations in a report presented to the Board of Directors. The full report may be found here.
2019 – 2020	**Member of the Select Group for Graduate Curriculum Redesign** | Participated in the strategic planning process for Michigan State University's Microbiology & Molecular Genetics Department, focusing on curriculum redesign. The committee members and I advocated for a shift away from a curriculum focused on teaching facts to one that emphasizes critical thinking, the nature, practice, and philosophy of science, and epistemological thinking. We met with department leaders to discuss

	introducing a new course, modeled after the R^3 Initiative at Johns Hopkins. My colleague, Dr. Zachary Blount, now leads this initiative as the Director of Graduate Education Innovation.
2018	**Department of Microbiology & Molecular Genetics Host for Seminar Speaker Adam Lauring** | Michigan State University
2018	**Department of Microbiology & Molecular Genetics Host for Seminar Speaker Michael Baym** | Michigan State University
2017 – 2019	**Darwin Discovery Day Volunteer** | I taught the public about experimental evolution and the Long-Term Evolution Experiment (LTEE) at the Michigan State University Museum
2017	**Department of Microbiology & Molecular Genetics Student Coordinator for Faculty Candidate, Dr. Jeffrey Barrick** | Michigan State University
2015 – 2020	**BioMolecular Science Gateway Program Recruitment** | Michigan State University
2015 – 2016	**Department of Microbiology & Molecular Genetics Faculty Meeting Representative** | Michigan State University
2015	**Microbiology Day Volunteer** | I taught the public about bacterial chemotaxis and motility | Impression 5 Science Museum

MEDIA COVERAGE

2025	"Cleveland Clinic researchers develop scoring system to anticipate antibiotic resistance." **Cleveland Clinic Lerner Research Institute News**. *Feature article describing our PNAS study, including a new metric to predict antibiotic resistance.* Article link.
2022	"Microbiologists at Work" in ***Microbe*, 3rd Edition** by Swanson M.S., Joyce E.A., Horak R.E.A. Washington, DC: ASM Press (2022). *Profiled as a featured scientist in the "Microbiologists at Work" series, highlighting my research on the evolution of antibiotic resistance.* Book link.
2021	"Traversing STEM with Disabilities: Spotlight on Kyle Card." **ASM Spotlight**. *Profile article highlighting my research and experiences.* Article link.
2019	**"**Overcoming Obstacles: Scientist Excels while Dealing with Syndromes." **MSU Today**. *Profile article highlighting my research and experiences.* Article link.
2019	**The Sci-Files Podcast**. *Discussed the evolution of antibiotic resistance and mentoring alongside my mentee, Jasper Gomez*. Podcast link.
2019	**WKAR Radio Interview**. *Discussed disability advocacy and shared my story about how I became a research scientist.* Article link.

SOCIETY MEMBERSHIPS

2023 – Present	American Association for Cancer Research (AACR)
2020 – Present	Society for the Study of Evolution (SSE)
2015 – Present	American Society for Microbiology (ASM)
2014 – Present	American Association for the Advancement of Science (AAAS)

REFERENCES

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