

Kyle J. Card, Ph.D.

HHMI Hanna H. Gray Postdoctoral Fellow

Cleveland Clinic Research
9500 Euclid Ave., Cleveland, OH 44195
Phone: 517-643-1747 | Email: cardkyle1@gmail.com | Website: kylejcard.com

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: 575

h-index: 7 (Google Scholar, as of June 26, 2026)

- 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>
- 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>
- 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 | <p>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.</p> |
| 2020 – 2021 | <p>Diversity Supplement
 National Cancer Institute (NIH/NCI)</p> |
| 2020 | <p>Ralph Evans Award
 Department of Microbiology & Molecular Genetics Michigan State University</p> |

- 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 high school student proposals 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 with the charge to elevate and embody inclusive diversity with 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 the Microbiology & Molecular Genetics Department at Michigan State University, 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 R³ 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

"Cleveland Clinic researchers develop scoring system to anticipate antibiotic resistance." **Cleveland Clinic Lerner Research Institute News** (October 3, 2025). *Feature article describing our PNAS study, including a new metric to predict antibiotic resistance.* [Article link.](#)

"Traversing STEM with Disabilities: Spotlight on Kyle Card." **ASM Spotlight** (December 2, 2021). *Profile article highlighting my research and experiences.* [Article link.](#)

"Overcoming Obstacles: Scientist Excels while Dealing with Syndromes." **MSU Today** (December 4, 2019). *Profile article highlighting my research and experiences.* [Article link.](#)

The Sci-Files Podcast (July 21, 2019). *Discussed the evolution of antibiotic resistance and mentoring alongside my mentee, Jasper Gomez.* [Podcast link.](#)

WKAR Radio Interview (June 18, 2019). *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

Dr. Richard E. Lenski

Professor, Michigan State University
Department of Microbiology, Genetics, and Immunology
567 Wilson Rd., Room 6177
East Lansing, MI 48824
lenski@msu.edu

Dr. Jacob G. Scott

Professor, Case Western Reserve University
Department of Molecular Medicine, School of Medicine
2111 E. 96th Street, NE6
Cleveland, OH 44106
scottj10@ccf.org

Dr. Robert A. Bonomo

Professor, Case Western Reserve University
Department of Medicine, School of Medicine
12200 Fairhill Rd.
Cleveland, OH 44120
robert.bonomo@med.va.gov