Lindsey Marie Markowitz (she/her/hers)
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Education

Ph.D. Candidate, Concentration in Behavior, Ecology, Evolution, and Systematics, 2021-Present
Department of Biological Sciences
University of Maryland, College Park, MD
Research Interests: Host-Microbe Symbioses , Microbiome-Mediated Pathogen Resistance, Disease Ecology, Parasitology, Bee Biology

B.S. in Biological Sciences, Minor in Microbiology, 2021
University of the Sciences, Philadelphia, PA
Distinction: Magna Cum Laude

A.S. in General Sciences, Concentration in Biological Sciences, 2018
Ocean County College, Toms River, NJ
Distinction: Magna Cum Laude

Research

Evans Lab, USDA-Agricultural Research Service, Bee Research Laboratory, 2021-Present
Hawthorne Lab, University of Maryland, 2021-Present

- Co-advised by Dr. Jay D. Evans (USDA-ARS) and Dr. David Hawthorne (University of Maryland) I conduct research covering broad topics of host-microbe symbioses, microbial ecology, epidemiology, bee biology, and parasitology.
- During my pre-doctoral research, I assessed the antiparasitic potential of floral volatiles against trypanosomatid parasites, engineered trypanosomatid reporter strains, and developed assays to assess infection intensity of honey bee gut parasites *in vivo* and *in vitro*.
- My dissertation research investigates microbiome-mediated suppression of parasite infection and activation of the host immune system, spatiotemporal trends in symbiont and parasite abundance, and uncovering genomic features linked to infection in a ubiquitous trypanosomatid gut parasite, *Lotmaria passim*.

Microbial Genetics Undergraduate Research Laboratory, University of the Sciences, 2020

- Advised by Dr. Jason Heindl, I utilized transposon mutagenesis to induce and screen for motility mutations in Agrobacterium tumefaciens and identified genetic loci of interest and potential novel genes regulating motility.
- I created a research poster to be presented at the 18th Annual Research Day at the University of the Sciences. Follow up research was halted due to COVID-19-related restrictions.

Science Education Alliance-Phage Hunters Advancing Genomes and Evolutionary Science Laboratory, University of the Sciences, 2018-2019

- Advised by Dr. Dana Zambito and Dr. C. Nicole Sunnen, I isolated and purified a novel bacteriophage using the host *Microbacterium foliorum* for submission to the international Actinobacteriophage Database.
- I worked in a team conducting bioinformatic analyses to annotate a genome of the novel bacteriophage DeepSoil15 for publication on NCBI GenBank. GenBank Accession Number: MK919482
- I presented this work at the 17th Annual Research Day at the University of the Sciences.

Animal Care & Environmental Education and Animal Behavior Internship, Philadelphia Zoo, 2017

- I conducted independent animal behavior research on the effects of enrichment items and 'play' behavior in Giant Otters.
- I delivered an oral presentation of my data to zoo staff which was used to implement modified enrichment practices during routine animal care.

Publications (*indicates co-first authorship and/or equal contribution of authors)

- **Markowitz, L.M.**, Garbarczyk, J., Palmer-Young, E.C., Evans, J.D. Honey bee gut symbionts mediate protection against a trypanosomatid parasite *in vivo*. (In Progress, 2024)
- Leong Ang, W.S.*, Blaszynski, M.*, Cai, J.*, **Markowitz, L.***, Maunders, E.*, Norlin, A.*, Womack, H.*, Li, F.W.* Genome sequences of two Nostoc strains isolated from hornworts. *Microbiology Resource Announcements* (Under Review, 2024)
- **Markowitz, L.M.**, Nearman, A., Zhao, Z., Boncristiani, D., Butenko, A., de Pablos, L.M., Marin, A. Xu, G., Machado, C., Schwarz, R.S., Palmer-Young, E.C., Evans, J.D. Somy evolution in the honey bee infecting trypanosomatid parasite, *Lotmaria passim*. *G3 Genes|Genomes|Genetics* jkae258 (2024)
- Evans, J.D., Chen, Y., Lamas, Z., **Markowitz, L.M.**, Palmer-Young, E., Boncristiani, D. Bee cups 2.0: P-Cups as single-use cages for honey bee experiments (Hymenoptera: Apidae) experiments. *Journal of Insect Science* 24, 6 (2024)
- Palmer-Young, E.C.*, **Markowitz, L.M.***, Huang, W.F., Evans, J.D. High temperatures augment inhibition of parasites by a honey bee gut symbiont. *Applied and Environmental Microbiology* 89, e01023-23 (2023)
- Palmer-Young, E.C., Ryabov, E.V., **Markowitz, L.M.**, Boncristiani, D.L., Grubbs, K., Pawar, A., Peterson, R., Evans, J. D. Host-driven temperature dependence of deformed wing virus infection in honey bee pupae. *Communications Biology* 2399-3642 (2023)
- Palmer-Young, E.C., **Markowitz, L.M.**, Grubbs, K., Zhang, Y., Corona, M., Schwarz, R., Chen, Y., Evans, J.D. Antiparasitic effects of three floral volatiles on trypanosomatid infection in honey bees. *Journal of Invertebrate Pathology* 194, 107830 (2022)

- Basu, A.*, Cameau, K.*, Gibson, A.*, Maher, S.*, McGlone, B.*, **Markowitz, L.***, Parekh, S.*, Sunnen, C.N.*, Garlena, R.A.*, Russell, D.A.*, Pope, W.H.*, Jacobs-Sera, D.*, Hatfull, G.F.* Mycobacterium phage DeepSoil15, complete genome. *NCBI GenBank* (2019) Accession Number: MK919482

Presentations

- **Markowitz, L.M.** "Fiery Friends Pickle Pests… Or Do They? Microbiome-mediated protection against a trypanosomatid parasite of honey bees" Speaker, Behavior, Ecology, Evolution, and Systematics Fall 2024 Seminar Series (2024)
- **Markowitz, L.M.** "Stepping Into Symbiosis: Insights from an advanced training course at the Marine Biological Laboratory" Speaker, Behavior, Ecology, Evolution, and Systematics 2024 Retreat, University of Maryland (2024)
- **Markowitz, L.M**., Garbarczyk, J., Huang, W.F., Evans, J.D., Palmer-Young, E "Fiery Friends Curdle Foes: High temperatures augment the inhibition of parasites by a honey bee gut symbiont" Invited Speaker, Symposium: "Insect Immune Systems: Same Same but Different but Still Same" Entomology 2023 in National Harbor, MD (2023)
- **Markowitz, L.M.**, Garbarczyk, J., Huang, W.F., Evans, J.D., Palmer-Young, E. "Fiery Friends Curdle Foes: High temperatures augment the inhibition of parasites by a honey bee gut symbiont" Poster, International Congress on Invertebrate Pathology and Microbial Control and the 55th Annual Meeting of the Society for Invertebrate Pathology in College Park, MD, *3rd Place Poster Presentation Award* (2023)
- **Markowitz, L.M.** "Fiery Friends Curdle Foes: High temperatures augment the inhibition of parasites by a honey bee gut symbiont" Speaker, Behavior, Ecology, Evolution, and Systematics Spring 2023 Seminar Series, *Best Graduate Research and Development Talk Award* (2023)
- **Markowitz, L.M.**, Palmer-Young, E., Hawthorne, D., Evans, J.D. "Into the Light: Engineering of trypanosomatid reporter strains" Poster, Behavior, Ecology, Evolution, and Systematics 2022 Retreat, University of Maryland (2022)
- **Markowitz, L.M**. "Novel Advances in the Treatment of Apis mellifera Pathogens and Colony Collapse Disorder" Speaker, Biological Sciences Senior Seminar, University of the Sciences (2021)
- Chan, V., **Markowitz, L.M.**, Ohl, H., Ouellette, D., Perkowski, J., Donnelly, K., Heindl, J.E. "Identification of genes that modulate motility of Agrobacterium tumefaciens in swim suppressor mutants via transposition" Poster, University of the Sciences (2020)
- **Markowitz, L.M.** "Climate Change and Increases in Aedes aegypti Vector-Borne Illness Risks." Speaker, Biological Sciences Senior Seminar, University of the Sciences (2020)
- Basu, A., Cameau, K., Gibson, A., Maher, S., McGlone, B., **Markowitz, L.M.**, Parekh, S., Sunnen. C.N. "Into the Deep: The Annotation of Bacteriophage DeepSoil15" Poster, 17th Annual
- Research Day, University of the Sciences (2018)
- **Markowitz, L.M**. "Giant Otters at the Philadelphia Zoo" Speaker, Environmental Education and Animal Behavior Summer 2017 Research Presentation Week (2017)

Teaching

University of Maryland, Graduate Teaching Assistant, 2021-2023

- **General Microbiology, 3 semesters:**
  I managed and instructed 20 students per class in a laboratory environment, created and implemented lesson plans and presentations, demonstrated laboratory techniques, assisted students with wet lab procedures, guided and initiated scientific discussion and peer review of work, provided timely and informative feedback on coursework, and ensured adherence to all standard operating and safety procedures.
- **Microbial Genetics, 1 semester:**
  I developed and tested laboratory protocols, prepared supplies and reagents for student use, coordinated laboratory equipment and supply needs with instructors and laboratory teaching assistants, and attended regular meetings to keep all teaching staff up to date.

University of the Sciences, Lead Tutor & Writing Lab Instructor, 2020-2021

- **Lead Tutor (4 semesters):**
  I worked one-on-one and in small groups to guide student peer review of work, assessed skill level and ability for students group assignments, and offered feedback on pre- and post-submission assignments.
- **Writing Lab Instructor (2 semesters):**
  I educated students in small groups following lesson plans provided by the department, guided peer review of work, and facilitated discussion between peers.

Philadelphia Zoo, Animal Care & Environmental Education and Animal Behavior Internships, 2017

- I implemented educational stations throughout the zoo, discussed and accommodated scientific information to a wide range of audiences, managed guest interaction stations during events, provided educational talks, and facilitated learning-through-doing activities.
- Assisted in developing Zoo on Wheels outreach programming for local public and private Philadelphia K-12 institutions.

Professional Development

Molecular and Cell Biology of Symbiosis 2024 (Marine Biological Laboratory, Woods Hole, MA, USA)

- I was awarded a certificate of completion for attending a research-based course which focused on facilitating state-of-the-art experimental approaches while teaching basic concepts alongside open research questions.
- I developed and mastered techniques for diverse model and non-model organisms to study host-microbe symbiosis in systems such as such as the Northern Star Coral (host: *Astrangia poculata*, symbiont: dinoflagellates), amoeba (host: *Dictyostelium discoideum*, symbiont(s): *Legionella pneumophila* and *Klebsiella Aerogenes*), fruit flies (host: *Drosophila melanogaster*,

symbionts: *Lactobacillus* spp.), and seedless plants such as Hornworts (host: Anthocerotophyta, symbionts: *Nostoc* spp. cyanobacteria).

- My work during this course resulted in the assembly and annotation of two cyanobacteria symbiont (*Nostoc* spp.) genomes and a publication detailing these results is currently under review for publication in the Microbiology Resource Announcements journal.

Mentorship

Undergraduate Research Mentor

- Jessica Garbarczyk, University of Maryland, College Park, MD, USA (2022-2025)
  I mentored Jessica for three years at the USDA-ARS Bee Research Laboratory where she worked closely with me on much of my dissertation research. She is listed as second author on a publication detailing our work in a honey bee host-parasite system and I am currently co-advising her undergraduate research thesis within the Biology Honors Program at the University of Maryland. She is expected to defend her thesis and graduate with honors (B.S. Biology) in May 2025 and will be co-authoring a manuscript detailing her research that we hope to submit in Spring 2025.
- Sulaman Shah, University of Maryland, Baltimore County, MD, USA (2021-2024)
  I mentored Sulaman for three and a half years at the USDA-ARS Bee Research Laboratory. Sulaman wanted to emphasize learning advanced techniques and transferable skills during his time at the lab, so much of our work together focused on mastering techniques such as microscopy, cell culturing, and techniques used in host-microbe symbiosis research. He graduated in May 2024 (B.S. Environmental Science) and is credited in the acknowledgements section of a publication detailing my dissertation research for his assistance in developing a technique to generate gnotobiotic bees.

High School Research Mentor

- I have mentored three high school students (*names redacted for privacy of minors*) at the USDA-ARS Bee Research Laboratory from Charles Herbert Flowers, Eleanor Roosevelt, and Oxon Hill High Schools in Prince Georges County, MD. Each student spent one academic year (September to May) in the lab completing a senior research project. I focus on teaching them relevant techniques for their projects and guide them in applying the scientific method to a hypothesis they pose. Two of these students currently attend undergraduate universities (Harvard University and the University of Wisconsin) where they are participating in honors research programs and one student is expected to complete their senior research project in May 2025.

Outreach

- USDA-ARS BARC Bee Lab Outreach Speaker, Beltsville, MD (2021-Present)
- Careers in Science and Technology Speaker, Pinelands Regional School District (7^{th}-12^{th}), Little Egg Harbor, NJ (2024)

- Pollinator Health Speaker, Assumption Regional Catholic School (PreK-8th), Galloway Township, NJ (2023-2024)
- Maryland Day Wildlife Quest Volunteer, University of Maryland, College Park, MD (2022-2023)
- ADA Accessibility Advocate, University of the Sciences, Philadelphia, PA (2019-2021)
- Alpha Delta Theta Outreach Chair, University of the Sciences, Philadelphia, PA (2018-2021)
- Zoo On Wheels Environmental Educator, Philadelphia Zoo, Philadelphia, PA (2017)

Funding

- National Science Foundation Graduate Research Fellowship; $162,000 (2023)
- Oak Ridge Institute of Science and Education Research Fellowship; $57,000 (2022-2023)
- University of Maryland Graduate School Dean's Fellowship; $7,500 (2021-2022)
- Dr. Louis Gershenfeld Memorial Prize for Microbiology (University of the Sciences, 2021)
- President's Scholarship (University of the Sciences, 2018-2021)
- Phi Theta Kappa Grant (University of the Sciences, 2018-2021)
- New Jersey Student Tuition Assistance Reward Scholarship (NJ STARS, 2016-2018)

Professional Affiliations

- Graduate Research Fellow (National Science Foundation, 2023-2026)
- Student Representative, Division of Beneficial Invertebrates (Society for Invertebrate Pathology, 2023-2025)
- President, Biology Graduate Student Association (University of Maryland, 2021-2025)
- Social Chair, Behavior, Ecology, Evolution, and Systematics Student Taskforce (University of Maryland, 2023-2024)
- Research Fellow (Oak Ridge Institute of Science and Education, 2022-2023)
- Phi Theta Kappa, Tau Iota Chapter Honor Society (Ocean County College, 2017-2018)

Awards and Honors

- Best Graduate Research and Development Talk Award (Behavior, Ecology, Evolution, and Systematics Seminar Series, 2023)
- 3rd Place Poster Presentation Award, Graduate Student Competition (55th Annual Meeting of the Society for Invertebrate Pathology, 2023)
- University of the Sciences Dean's List (2018-2021)
- Ocean County College President's List (2016-2018)

References

- Dr. Jay D. Evans, USDA-ARS – Bee Research Laboratory
- Dr. David J. Hawthorne, University of Maryland – Department of Entomology
- Dr. Erin Tran, University of Maryland – Department of Cell Biology and Molecular Genetics