Dee Ruttenberg

(they/them)

dmr4@princeton.edu

https://www.researchgate.net/profile/Dee-Ruttenberg

Employment History

2019 – present	◇ **Graduate Student Researcher,** Kocher Lab: Princeton University
2022 – present	◇ **Coordinator and Educator,** Prison Teaching Institute: Garden State Youth Correction, East Jersey State Prison, Edna Mahan Women's Correction
2023 – 2024	◇ **Course Designer,** Genomics: Princeton University
2019 – 2022	◇ **Hebrew School Teacher,** Har Sinai Synagogue
2017 – 2020	◇ **Undergraduate Researcher,** Kronforst Lab: Princeton University
2017 – 2024	◇ **Assistant in Instruction,** Genomics, Molecular Biology of the Cell, Molecular Biology I; Princeton University and University of Chicago

Education

2019 – present	◇ **Ph.D. Quantitative and Computational Biology, Princeton University (Expected May 2025)** Funded by NSF Graduate Research Fellowship Program: 2021-2023 Thesis title: *Variation across the life history of* Bombus impatiens.
2015 – 2019	◇ **B.S. with Research Honors. Biology and Linguistics, *Summa cum laude*, University of Chicago** Thesis title: *The evolution and genetics of sexually dimorphic 'dual' mimicry in the butterfly* Elymnias hypermnestra.

Awards

2023	◇ **Travel Grant**, Gordon Research Conference
2022	◇ **Travel Grant**, International Union for the Study of Social Insects
2021	◇ **Awardee: Graduate Research Fellowship Program**, National Science Foundation
2019	◇ **Dean's List, All Semesters**, University of Chicago
	◇ **Research Honors in Biological Sciences**, University of Chicago
2018	◇ **Honorable Mention: Graduate Research Fellowship Program**, National Science Foundation
2016	◇ **Runner up**, Google Games (Coding Competition)

Research Experience

2019-2024 ◇ **Graduate Student Researcher**, Kocher Lab, Princeton University.

- In the Kocher Lab, I studied individual behavioral variation in the bumblebee, *Bombus impatiens*. Bumblebees form seasonal colonies, whose social structure is strongly mediated by the physical presence of a queen. I sought to see how individuals vary in their response to queenlessness, using behavioral tracking and social network analysis.
- In my work, I showed that queenlessness is associated with an increase in interactivity at the colony level. Moreover, I showed that this increase in interactivity is not the result of an increase in the interactivity of *all* bees, but rather an increase in a small fraction of the colony: bees we referred to as 'influencers'. These highly-interactive influencers have a larger ovary size than other workers, but this physiological variation only manifests as behavioral variation when the queen is absent. Taken in sum, this suggests a mechanism whereby the presence of a queen masks the influence of worker reproductive potential on bumblebee social networks.
- In addition to my empirical research, I performed modeling work to understand how climate change will affect the social dynamics of bee species. While it has been known that social behavioral strategies are favored at warmer temperatures, I developed a competition-based, individual-focused model to provide a theoretical explanation for this behavioral transition. I showed that longer season lengths favor sociality, shorter season lengths favor solitarity strategies, and the two strategies can coexist at intermediate season lengths.
- With the Kocher Lab, I develop and disseminate open-source tools with a specific focus on applications in animal behavior and ecology, including open-source deep-learning based tracking software (NAPS), as well as automated quality control tools for behavioral analysis (TrackQC). These tools have seen adoption by a range of labs studying diverse insect systems. I support the adoption of these tools through presentations.
- My research with the Kocher Lab has led to publications in *Methods in Ecology and Evolution* and *Proceedings of the Royal Society: B*. My main thesis paper is currently in submission at *Proceedings of the National Academy of Sciences*. I have also collaborated with other labmates on several key projects which will be submitted in the coming years.
- In the Kocher Lab, I learned techniques in behavioral tracking, computational modeling, insect anatomy and dissection, insect rearing, quantitative genomics, and functional genomics. I also developed significant experience in grant writing (my research was supported by the NSF Graduate Student Research Fellowship) and academic citizenship (I presented by work at both local and international conferences, as well as through broader outreach: see below).

Research Experience (continued)

2017-2019 ◇ **Undergraduate Student Researcher**, Kronforst Lab, University of Chicago

- In the Kronforst Lab, I studied mimicry in the common palmfly, *Elymnias hypermnestra*. *E. hypermnestra* is a palatable butterfly which acts as a 'dual' mimic: males always mimic the poisonous *Euploea* and females mimic either *Euploea* or *Danaus*, depending on the subspecies. I sought to understand the genomic and evolutionary mechanisms which led to this mimicry pattern.
- Using techniques in population genomics, I showed that the switch between forms is associated with a single nucleotide polymorphism near the *WntA* gene. Moreover, the subspecies which mimic *Danaus* do not form a single monophyletic branch on the butterfly phylogeny. Taken in sum, this suggests incomplete lineage sorting as a mechanism by which female palmflies can potentially mimic two different models.
- This work resulted in a publication in *Proceedings of the Royal Society: B* in collaboration with the Lohman lab at CUNY University.
- With the Kronforst Lab, I learned how to sequence DNA from collected specimens and perform key computational pipelines in population genetics and functional genomics.

2016-2017 ◇ **Undergraduate Student Researcher**, Drummond Lab, University of Chicago

- In the Drummond Lab, I studied the heat shock response in *S. cerivisiae*. I sought to understand how mRNA condensation effects the rate of mRNA decay during and after the heat shock response.
- With the lab, I learned how to work with cell lines and yeast, protein purification, and classical molecular techniques such as PCR and Northern blotting.
- This work resulted in the development of key methods still used in the Drummond Lab.

Outreach and Teaching

2019-present ◇ **Biology Course Coordinator, Developer, Teacher: Prison Teaching Initiative**

- The Prison Teaching Initiative (PTI) is a multi-university wide initiative which teaches 3-5 college level STEM courses a semester across 5 prisons in New Jersey (Garden State, East Jersey, Edna McMahan, South Woods, Northern State Prison).
- As course coordinator, I managed teaching teams of four, including syllabus development, scheduling, coordinating between PTI, prisons throughout New Jersey, and Raritan Valley Community College (our accreditor for STEM courses).
- I developed a lab-based Human Biology course, taught at Garden State Youth Correctional. The aim of this course is to introduce students to the study of anatomy and physiology in an active, curiosity-driven, environment, and help them develop the ability to think critically about their own bodies and health.
- As a teacher, I also taught 6 math and biology courses ('Intro to Mathematics', 'Principles of Biology', and 'Human Biology'), including units on anatomy, physiology, microbiology, and biotechnology.

Outreach and Teaching (continued)

2022-2024 ◇ **Course Designer, Assistant in Instruction: 'Genomics'**

- 'Genomics' is an undergraduate-level course taught at Princeton University, crosslisted with the Evolutionary Biology and Molecular Biology departments. The aim is to introduce students to key analytical and technical concepts in genomics and computational biology through a combination of lecturing and step-by-step computational labs.
- As a designer, I developed 5 computational labs for the course, leading students through key pipelines and analyses in computational biology. I also designed a set of introductory discussion sections and lectures to acquaint unfamiliar students with key concepts in computer science and statistics.
- After launching the course, I worked as assistant in instruction for 2 years, leading discussion sections, grading projects, and developing materials.

2021-2024 ◇ **Department Representative: Graduate Student Government**

- Princeton Graduate Student Government (GSG) is a body of representatives from all department who works with the university administration to advocate for the needs of graduate students.
- With GSG, I worked with the Academic Affairs coordinator to develop a standardized portal to connect students with mental health resources available both on and off campus.

2020-2022 ◇ **Coordinator: QCB Virtual Open House**

- The QCB Virtual Open House was an initiative launched in 2020 to introduce students from backgrounds underrepresented in biology to our department, and prepare them for a successful
- As a coordinator, I arranged for speakers, events, and advertising for the event. I also arranged programming on successful cover letter writing and interview prep in conjunction with the G3 initiative at Princeton University.

2019-2019 ◇ **Course Designer: 'Scientific Communication'**

- 'Scientific Communication' is a flipped-classroom undrgraduate at the University of Chicago. The aim is give students to practice writing and speaking about scientific concepts for a general audience. The course integrates both in-class practica and discussions on scientific literature with virtual lectures on writing and developing a scientific 'story'.
- With Dr. Carrie Rinker-Schaefer, I designed the syllabus for this course and wrote workbooks and packets for discussion sections.

Research Publications

Journal Articles

1 D. M. Ruttenberg, S. W. Wolf, A. E. Webb, *et al.*, "The queen masks the influence of worker reproductive potential in bumblebee social networks," *bioRxiv*, 2025. URL: https://www.biorxiv.org/content/10.1101/2025.01.07.630106v1.

2 D. M. Ruttenberg, S. A. Levin, N. S. Wingreen, and S. D. Kocher, "Variation in season length and development time is sufficient to drive the emergence and coexistence of social and solitary behavioral strategies," *Proc Biol Sci.*, 2024. URL: https://royalsocietypublishing.org/doi/full/10.1098/rspb.2024.1221?af=R.

3 S. W. Wolf, D. M. Ruttenberg, D. Y. Knapp, *et al.*, "Naps: Integrating pose estimation and tag-based tracking," *Methods in Ecology and Evolution*, vol. 14, no. 10, pp. 2541–2548, 2023. DOI: https://doi.org/10.1111/2041-210X.14201. eprint: https://besjournals.onlinelibrary.wiley.com/doi/pdf/10.1111/2041-210X.14201.

4 D. M. Ruttenberg, N. W. VanKuren, S. Nallu, *et al.*, "The evolution and genetics of sexually dimorphic 'dual' mimicry in the butterfly elymnias hypermnestra.," *Proc Biol Sci.*, vol. 288(1942), p. 20 202 192, 2021. URL: https://pubmed.ncbi.nlm.nih.gov/33434461/.

Conferences and Symposia

2024 ◇ **International Congress of Entomology,** "The queen masks the influence of worker reproductive potential in bumblebee social networks".

2023 ◇ **Gordon Research Conference: Mechanisms of Social Communication in all Kingdoms ,** "Bumblebee colonies rapidly transform social networks in response to queen removal".

2022 ◇ **International Union for the Study of Social Insects,** "NAPS and SocioQC: benchmarking behavior".

2021 ◇ **Cold Spring Harbor Laboratory: Biology and Genomics of Social Insects,** "Modeling the competition between social and solitary behavioral strategies across environmental gradients", Virtual.

2019 ◇ **BSCD Honors Thesis Symposium,** "Dual mimicry in the common palmfly *Elymnias hypermnestra*".

Skills

Languages ◇ Fluent in English. Working in Hebrew.

Coding ◇ Python, R, Matlab, SQL, XML/XSL, LaTeX, Git

Misc. ◇ Game developer with Null Signal Games, leader of nature walks throughout the New Jersey community, avid puzzle setter and solver.

References

Available on Request