

AVA MACKAY-SMITH

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EDUCATION

Duke University Graduate School and Medical Center

August 2022-present

Ph.D. Candidate in University Program in Genetics and Genomics

Certificate In College Teaching

Thesis Advisor: Dr. Greg Wray

Thesis: Gene regulatory mechanisms of mimicking *Heliconius* butterflies: inter- and intra-species variation at genetic and epigenetic levels

Wellesley College

August 2016-May 2020

B.A. in Biological Sciences, *magna cum laude*. Unweighted GPA: 3.8

Thesis Advisor: Dr. Andrea Sequeira

Thesis: Host-specific gene expression as a tool to facilitate establishment of introduced weevil populations in the United States

RESEARCH EXPERIENCE

Duke University Graduate School, Department of Biology

April 2023 - present

Ph.D. Candidate, Wray Lab

- Developing research on structural variation and polymorphism during hybridization and gene flow in wild *Heliconius* butterfly populations with long-read methods and pangenomic analysis
- Adapting and optimizing methods for simultaneous assessment of epigenomic state variation and three-dimensional chromatin architecture in insect tissue during development
- Facilitating fieldwork on *Heliconius* butterflies in Panama through a Smithsonian Tropical Research Institute Predoctoral Fellowship

Yale School of Medicine, Department of Genetics

Sep 2021 - July 2022

Lab Operations Manager and Research Assistant, Dr. Steven Reilly

- Developed workflows for lentivirus-based delivery of highly multiplexed, inducible CRISPR interference libraries in several human cell lines
- Collaborated with the ENCODE4 consortium to develop best practices for CRISPR-based functional perturbation screens
- Oversaw the management of lab setup, the development of lab workflows, standards of operation, training of undergraduate students, and shaping lab culture for Dr. Steven Reilly

Broad Institute of MIT and Harvard

Jul 2020 - Sep 2021

Research Associate I, Dr. Pardis Sabeti

- Assisted with protocol development and analysis of a workflow for characterizing positively selected human variants in regulatory elements, HCR-FlowFISH
- Performed functional perturbation methods for analyzing the effects of human variation and nominated causal phenotypic variants with massively parallel reporter assays, hybridization chain reactions, fluorescence *in-situ* hybridization, flow cytometry, chromatin immunoprecipitation, and homologous directed repair

Wellesley College, Department of Biological Sciences

Sept 2017 - May 2020

Thesis Candidate and Student Researcher, Dr. Andrea Sequeira

- Completed an honors thesis on species introduction and differential gene expression of *Naupactus* polyphagous parthenogenetic weevils
- Built RNA-seq libraries and adapted methylation-sensitive restriction polymorphism analysis methods to identify differences in gene expression and regulation in non-native insects feeding on native host plants

FELLOWSHIPS AND AWARDS

Duke Genomics Travel Award, Center for Advanced Genomic Technologies (CAGT)	2024
Duke University Department of Biology, Grant in Aid of Research	2024
National Science Foundation Graduate Research Fellow	2022 - present
James B. Duke Fellowship, Duke University Graduate School	2022 - present
Smithsonian Tropical Research Institute (STRI) Predoctoral Fellow	2023 - 2024
ENCODE4 Consortium Team Science Award: CRISPR Working Group	2022
Wellesley College Fiske Prize in Biology	2020
Wellesley College Camellia Student Leadership Nominee	2020
Wellesley College Summer Research Grant recipient	2020
Wellesley College Research Grant recipient	2019

PUBLICATIONS

Mackay-Smith A, Wray GA. Genome mountaineering: expanding horizons of the three-dimensional genome for the intrepid evolutionary adventurer. Under review *Genome Biol and Evol*

Yao D*, Tycko J*, Oh JW*, Bounds LR*, Gosai SJ*, **Mackay-Smith A**, Lataniotis L, Doughty BR, Gabdank I, Schmidt H, Guerrero-Altamirano T, Siklenka K, Guo K, White AD, Youngworth I, Andreeva K, Ren X, Barrera A, Luo Y, Yardımcı GG, Tewhey R, Kundaje A, Greenleaf WJ, Sabeti PC, Leslie C, Pritykin Y, Moore JE, Beer MA, Gersbach CA, Reddy TE, Shen Y, Engreitz JE, Bassik MC, Reilly SK. Multicenter integrated analysis of noncoding CRISPRi screens. *Nat Methods* 21, 723–734 (2024). <https://doi.org/10.1038/s41592-024-02216-7>

Xue JR, **Mackay-Smith A**, Mouri K, Fernandez-Garcia M, Dong MX, Akers JF, Noble M, Li X, Zoonomia Consortium, Lindblad-Toh K, Karlsson EK, Noonan JP, Capellini TD, Brennand KJ, Tewhey R, Sabeti PC, Reilly SK. The functional and evolutionary impacts of human-specific deletions in conserved elements. *Science* 380, eabn2253 (2023). <https://doi.org/10.1126/science.abn2253>

Rodriguero MS, Confalonieri VA, **Mackay-Smith A**, Dornon MK, Zagoren E, Palmer A, Sequeira AS. Genetically depauperate and still successful: few multilocus genotypes of the introduced parthenogenetic weevil *Naupactus cervinus* (Coleoptera: Curculionidae) prevail in the Continental United States. *Insects* 14(2):113 (2023). <https://doi.org/10.3390/insects14020113>

Reilly SK*, Gosai SJ*, Gutierrez A, **Mackay-Smith A**, Ulirsch JC, Kanai M, Mouri K, Berenzy D, Kales S, Butler GM, Gladden-Young A, Bhuiyan RM, Stitzel ML, Finucane HK, Sabeti PC, Tewhey R. Direct characterization of cis-regulatory elements and functional dissection of complex genetic associations using HCR–FlowFISH. *Nat Genet* 53, 1166–1176 (2021). <https://doi.org/10.1038/s41588-021-00900-4>

Mackay-Smith A, Dornon MK, Lucier R, Okimoto A, Mendonca de Sousa F, Rodriguez M, Confalonieri V, Lanteri AA, Sequeira AS. Host-specific gene expression as a tool for introduction success in *Naupactus* parthenogenetic weevils. *PLoS ONE* 16(7): e0248202 (2021). <https://doi.org/10.1371/journal.pone.0248202>

POSTER AND ORAL PRESENTATIONS

- Biology of Genomes Meeting, Cold Spring Harbor** 2025
Exploring hybridization persistence—Gene regulatory dynamics and sex-specific recombination landscapes in Lepidoptera
- ASN, SSE, SSB Evolution National Meeting** 2019
Host-specific gene expression and invasiveness in parthenogenetic weevils
- Wellesley Ruhlman Conference** 2019
Colonization histories and epigenetic variation in the parthenogenetic, invasive weevil Naupactus cervinus

WORKSHOPS AND TRAINING

- Johns Hopkins University Visualizing Science Workshop Series** Sept. - Dec. 2024
 · Participated in an online workshop series hosted by Dr. Barrett Klein (University of Wisconsin-La Crosse) through Johns Hopkins University, aimed at teaching methods for creating visualizations and illustrations of biological phenomena and scientific concepts.
- Duke Undergraduate Research Support Entering Mentoring Workshop** June 2024
 · Completed mentorship training with Duke's URS office, aimed at developing strong mentoring relationships with faculty advisors and undergraduate trainees.
- Bruce Weir Summer Institute in Statistical Genetics** May - June 2024
 · Received a BWSISG scholarship to attend modules on Probability & Statistics, Quantitative Genetics, and Statistical Genetics alongside an international group of academics, professionals, and graduate students.

PROFESSIONAL EXPERIENCE

- Wellesley College Botanic Gardens** February 2019 - May 2020
Curations Assistant and Gardens Docent
 · Collaborated with horticultural personnel to index existing and new collections, handling multi-platform data input and purchasing records over multiple data collection years
 · Researched and protected IUCN-listed rare specimens and other plants of special interest
- Smithsonian Conservation Biology Institute** Summer 2019
Fieldwork and Analysis Volunteer
 · Completed native orchid and forest health surveys on private and public properties around the Shenandoah National Park as a part of the Changing Landscapes Initiative (CLI) under Dr. Iara Lacher.
 · Assisted with GIS analysis and data management of survey information in the lab across the study area
- Bili Nursery** September 2018 - December 2018
Horticultural Volunteer
 · Assisted with the management of native plant orders for local enterprises, wholesale landscapers, and Parks Victoria.

- Reported growing seedlings in varying life stages and of various species, and prepared pots for more than 200 seedlings and cuttings daily

Uppsala University

Summer 2018

Field Research Assistant in the Gustafsson lab

- Banded adult birds with Dr. Lars Gustafsson's group, alongside regularly handling and banding young chicks and fledglings from Collared Flycatcher nests on the island of Gotland
- Worked 12-hour days in the field in unmarked forests using GPS and compass coordinates for navigation and maintained 450 nest boxes for cavity-nesting bird species in a 10-person field team

Institute of Science and Technology, Vienna

Summer 2017

Field Research Assistant in the Barton lab

- Spent 10- to 14-hour days in field teams collecting plant samples from mountainous slopes, accessed via abseiling and rock-climbing
- Logged detailed, custom GIS data using Trimble 3000 GPS systems for *in situ* samples, and collected over 1000 biological samples of plant tissue

MENTORING AND OUTREACH**Duke University Program Department of Biology**

Winter 2024 - Spring 2025

Undergraduate mentor

- Mentored a Duke Biology undergraduate student through learning new wetlab-based genetics and research techniques, culminating in a departmental honors thesis for the Biology major.

Duke University Program in Genetics and Genomics

Fall 2022 - Spring 2024

Recruitment Committee

- Assisted with UPGG recruitment weekend scheduling logistics, including faculty meetings, panel organization, catering, and student events.

Project SHORT

Sep 2022 - April 2024

Volunteer Graduate Mentor

- Volunteering in an international peer network designed to reduce cost and knowledge barriers in the graduate school application process; mentoring domestic and international STEM Ph.D. applicants in genetics, evolution, and ecology

SciREN Triangle

Sep 2022, 2023

Lesson Planning Participant

- Constructed a lesson plan on biological mimicry with interactive digital and in-person components for middle-school students, 2023
- Collaborated on the structure, writing, and dissemination of an evolutionary biology-focused lesson plan for elementary and middle school educators that meets North Carolina state educational standards, 2022

Broad Institute of Harvard and MIT

Jan 2021 - Aug 2021

BroadRATS Working Group for Sexual Harassment and Discrimination Member

- Collaborated with other Research Associates and Technicians to develop better reporting procedure for workplace sexual harassment and discrimination; worked with external Ombuds office to improve resources available to all Broad employees for a safe and equitable workplace