

# AVA MACKAY-SMITH

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## EDUCATION

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**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

**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

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**Duke University Graduate School, Department of Biology** April 2023 - present

*Graduate Student, Wray Lab*

- Developing wetlab and computational approaches to characterize gene regulatory divergence in *Heliconius* butterfly development at the genetic and epigenetic levels
- Active collaborations with Arnaud Martin's lab at George Washington University and Owen McMillan's group at the Smithsonian Tropical Research Institute in Panama

**Yale School of Medicine, Department of Genetics** Sep 2021 - July 2022

*Lab Operations Manager and Research Assistant, Reilly Lab*

- 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, postdoctoral mentor from the Sabeti lab
- Active contributor to the ENCODE4 Consortium CRISPR screen working group as part of the Sabeti Functional Characterization Center

**Broad Institute of MIT and Harvard** Jul 2020 - Sep 2021

*Research Associate I, Sabeti Lab*

- Contributed to a project in the Sabeti lab focusing on the functional characterization of positively selected human variants, specifically those within genetic regulatory elements or linked to disease traits, including the protocol development for HCR-FlowFISH
- Assisted with graduate student work on human-specific conserved deletions and variants in noncoding regions

**Wellesley College Department of Biological Sciences** Sept 2017 - May 2020

*Thesis Candidate and Student Researcher in the Sequeira lab*

- Completed an honors thesis on species introduction and differential gene expression of *Naupactus* polyphagous parthenogenetic weevils with Dr. Andrea Sequeira, addressing broader evolutionary questions regarding epigenetics and gene expression using molecular methods.
- Maintained short-term live adult and juvenile insect specimens and preserved specimens in long-term storage

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**FELLOWSHIPS AND AWARDS**


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

**PROFESSIONAL EXPERIENCE**


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**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.
- Repotted 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

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**TEACHING AND MENTORING EXPERIENCE**


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**SciREN Triangle**

Sep 2023

*Lesson Planning Participant*

- Constructed a lesson plan on biological mimicry with interactive digital and in-person components for middle-school students

**FEMMES+**

March 2023

*Capstone Day Lesson Plan Leader*

- Taught a one-day workshop to elementary and middle school students on climate change and evolutionary biology

**SciREN Triangle**

Sep 2022

*Lesson Planning Participant*

- 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

**Project SHORT**

Sep 2022 - present

*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

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**OUTREACH AND UNIVERSITY SERVICE**


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**Duke University Department of Biology**

Fall 2023-Present

*Graduate Steering Committee*

- Incoming graduate steering committee responsible for organizing intradepartmental events for graduate students, specifically incoming students

**Graduate Science Communication at Duke Video Workshop**

August 2023

*Event Organizer*

- Applied for and was awarded funding from Duke's Graduate School to organize a two-day science communication video workshop and film festival for STEM graduate students across Duke

**Society for Duke Fellows**

Spring 2023

*GradX Advertising Committee*

- Collaborated with other SDF members on the advertising committee of the spring graduate speaker symposium, GradX, to solicit abstracts, answer submission questions, and advertise campus-wide.

**Duke University Program in Genetics and Genomics**

Fall 2022 - Present

*Recruitment Committee*

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

**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

**MSPCA-Angell West Medical Center**

December 2019 - Aug 2021

*Trainer and Volunteer Advisory Council Member*

- Co-ordinated new volunteer shadowing and training to prepare for solo shifts and developed knowledge-related resources and event programming to improve the quality of the training experience and ensure multiple routes for volunteer growth & commitment
- Interfaced between clients and veterinary nurses/technicians/doctors for medical questions and visiting around procedure times
- 2020 MSPCA-Angell Volunteer Certificate of Achievement in Communications Planning

**PROFESSIONAL ASSOCIATIONS**

Society of Duke Fellows, 2022 -

Sigma Xi Scientific Research Honor Society, 2020 -

American Society of Naturalists, 2019 -

**POSTER AND ORAL PRESENTATIONS****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***PUBLICATIONS**

Yao D\*, Tycko J\*, Oh JW\*, Bounds LR\*, Gosai SJ\*, Lataniotis L, **Mackay-Smith A**, Doughty BR, Gabdank I, Schmidt H, Youngworth I, Andreeva K, Ren X, Barrera A, Luo Y, Siklenka K, Yardımcı GG, The ENCODE4 Consortium, 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. Multi-center integrated analysis of non-coding CRISPR screens. Preprint: *BioRxiv* (2022). <https://doi.org/10.1101/2022.12.21.520137>

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, **Ava Mackay-Smith**, 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, Rodriguero 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>

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**SELECTED STEM COURSEWORK**


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**Selected Undergraduate**

Wellesley College, 2016-2020

- **BISC198 Statistics in the Biosciences.** *Topics covered:* Probabilistic statistical methods, basic Bayesian statistical testing, contingency and chi-square analysis, basic correlation and regression analysis, nonparametric approaches and applications. Involved manual statistical calculations and basic computational approaches in Excel and GraphPad Prism.
- **BISC202 Evolution with Lab.** *Topics covered:* Phylogenetic inference, natural selection and Hardy-Weinberg equilibrium calculations, microevolutionary and macroevolutionary forces and patterns, sexual selection, polygenic evolution, theories of speciation. Involved lecture and lab with simulation studies, computational phylogenetic construction with PAUP\* and MrBayes, and wetlab protein purification and PCR-based allele identification.
- **BISC219 Genetics with Lab.** *Topics covered:* Modes of inheritance, genotypic probability calculations, independent assortment and linkage disequilibrium, recombination frequency and mapping, epistatic interactions, basic sequencing overview, pre-transcriptional and post-transcriptional regulation across the tree of life, forward and reverse genetic screens and design, basic population genetics and modeling deviations from Hardy-Weinberg equilibrium. Involved lecture and lab with wetlab linkage mapping and mutational isolation via crossing in *C. elegans*.
- **BISC305 Evolution Seminar.** *Topics covered:* Origins of life and energetics in evolution, endosymbiosis and eukaryotic evolution, animal diversification and the Cambrian explosion, anatomical diversification and the evolution of tetrapods, mammalian physiological innovation, life history reconstruction, major life transitions and innovations. Involved paper discussion and presentation in a seminar-style setting.
- **BISC333 Genomics and Bioinformatics with Lab.** *Topics covered:* Sequencing methods, alignment tools, BLAST applications and interpretations, genome assembly approaches, genome annotation and functional inference, phylogenomic methods and tools, single-cell genomics, RNA sequencing and differential expression analysis, metagenomic approaches, proteomic methods, metabolic pathway inference, basics of machine learning applications in -omic studies. Involved lecture, paper discussion, and lab with solely computational lab based in Unix tools and GUIs on an open computational cluster, utilizing BLAST, ClustalW, MEGA, iTOL with bacterial genomic/proteomic datasets.

**Selected Graduate**

Duke University, 2022-present

- **UPGEN701 Advanced Topics in Genetics and Genomics**
- **BIO723 Statistical Computation for Biologists**
- **BIO790S Big Ideas in Evolution Seminar**
- **UPGEN778/CMB710 Modules:** Epigenomic Methodologies; Genomic Technologies; Genomics of Adaptation; Mechanisms of Chromatin Assembly and Epigenetic Inheritance; Tidybiology; 3D Genome Organization; Mechanisms of Early Development