

Miles Roberts
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Education

- 2020-Present Michigan State University
PhD Student, Genetics and Genome Sciences, GPA: 4.0
Advisor: Dr. Emily Josephs
- 2017-2020 Washington State University, Vancouver, WA, GPA: 4.0
Bachelor of Science in Biology, Summa Cum Laude
Minors: Chemistry and Mathematics
Certificate: Quantitative Biology
- 2018 General GRE Percentiles: 92nd Analytical Writing,
88th Verbal Reasoning,
83rd Quantitative Reasoning
- ACS organic chemistry exam: 100th percentile
ACS general chemistry exam: 99th percentile
- Coursera, University of California San Diego, Grade: 100 %
Biology Meets Programming: Bioinformatics for Beginners
- Coursera, University of California Santa Cruz, Grade: 100 %
Bayesian Statistics: From Concept to Data Analysis
- 2015-2017 Clark College, Vancouver, WA, GPA: 4.0
Associates of Arts Degree in Biology with Highest Honors
High School Diploma

Publications

Wendlandt C, Helliwell E, **Roberts M**, Nguyen K, Friesen M, Wettberg E, Price P, Griffiths J, Porter S. (2020) Decreased coevolutionary potential and increased symbiont fecundity during the biological invasion of a legume-rhizobium mutualism, *Evolution*,
<https://doi.org/10.1111/evo.14164>

Roberts M, Seymour H, Dimitrov A. (2020) Selectively caring for the most severe COVID-19 patients delays ICU bed shortages more than increasing hospital capacity, *SIAM Undergraduate Research Online*, <https://doi.org/10.1137/20S1379149>

Peer reviews

2021 **New Phytologist**: Plasticity, pleiotropy, and fitness trade-offs in *Arabidopsis* genotypes with different telomere lengths

Research Experience

2020-

Present

PhD student, Michigan State University

- Performed univariate, multivariate, SNP-based, and k-mer-based genome-wide associations to determine the genetic basis of correlated pairs of traits in *Arabidopsis thaliana*. Mentor: Dr. Emily Josephs. Duration: 8 weeks
- Constructed *de novo* motif discovery pipeline to identify cis-regulatory elements near circadian clock-regulated genes in *Solanaceae* plants. Mentor: Dr. Eva Farré. Duration: 8 weeks
- Constructed phylogenetic analysis pipeline to investigate divergence in circadian clock proteins among wild and domesticated *Solanaceae* plants. Mentor: Dr. Robin Buell. Duration: 8 weeks

2019-

2020 Lab manager, Porter Plant-Microbe Lab, Washington State University Vancouver

- Conducted green-house experiment on additional 450 plants to investigate whether complementation of a knocked-out gene in rhizobia bacteria, *hrrP*, affected symbiosis outcomes between legumes and rhizobia.
- Mentor: Dr. Stephanie Porter

2018-

2019 Technician, Porter Plant-Microbe Lab

- Tested for local adaptation to nickel-rich or nickel-poor environments in > 300 strains of wild soil bacteria
- Mentor: Dr. Stephanie Porter

2017-

2018 Intern, Porter Plant-Microbe lab, Washington State University Vancouver

- Conducted green-house experiment on 400 plants to investigate whether complementation of a knocked-out gene in rhizobia bacteria, *hrrP*, affected symbiosis outcomes between legumes and rhizobia.
- Collected 374 data points for a meta-analysis (not yet published) examining whether the effects of rhizobial symbionts on legume fitness are additive.
- Mentor: Dr. Stephanie Porter

Teaching Experience

2019-

2020 Trained four undergraduate researchers in general laboratory techniques, Washington State University Vancouver, Supervisor: Dr. Stephanie Porter

2018 Paid tutor in General Genetics and Organic Chemistry, Washington State University Vancouver Quantitative Skills Center, Supervisor: George Salos

Awards and Honors

2021 National Science Foundation Graduate Research Fellowship, Honorable Mention
NRT IMPACTS Fellowship, Michigan State University

- Research question: Does the genetic basis of the trade-off between growth rate and flowering time vary with latitude in *Arabidopsis thaliana*?
 - Mentors: Dr. Emily Josephs, Dr. Arjun Krishnan
- Plant Biotechnology for Health and Sustainability Fellowship, Michigan State University
- Research question: What is the genetic basis of interspecies variation in gene expression?
 - Mentor: Dr. Emily Josephs
- Semifinalist in Reach Out Science Communication Competition
- 2020 Outstanding Researcher in Biology award, WSU Vancouver
 1st place in Undergraduate Research Showcase Poster Competition, WSU Vancouver
 1st place in Student Competition Using Differential Equation Modeling, SIMIODE
 College of Natural Sciences Recruiting Fellowship, Michigan State University
- 2019 NSF Research Experience for Undergraduate Scholar, summer.
- Question: What genetic factors explain variation in cooperation between the plant *Medicago polymorpha* and the soil bacterium *Ensifer medicae*?
 - Mentor: Dr. Stephanie Porter
- WSU-Pullman Plant Sciences Symposium Poster Competition, Honorable Mention
 WSUV Student Research Excellence Award
- For superior use of clear communication and library resources in research
 - Question: Can humans manipulate trade-offs between antibiotic resistance and other traits to constrain the evolution of antibiotic resistance?
 - Mentor: Dr. Stephanie Porter
- President's Honor Roll status at WSUV (Fall 2017 – Summer 2019)
 WSUV Undergraduate Travel Grant (award to attend evolutionary biology conference)
- 2018 Auvil Scholars Fellowship (award that supports promising undergraduate research)
- Question: How does evolving a higher tolerance to nickel, a toxic heavy metal, impact the growth of wild *Mesorhizobia* bacteria?
 - Mentor: Dr. Stephanie Porter
- WSUV Undergraduate Travel Grant (award to attend two research conferences)
 WSUV Academic Achievement Award (for maintaining > 3.5 GPA as full-time student)
- 2017 Washington State Honors Award (GPA and SAT scores in top 10 % of WA high school graduates)
 Vice President's Honor Roll status at Clark College (Fall 2015 – Spring 2017)

Outreach and Service Experience

Fall 2021 Peer mentor for Graduate Recruitment Initiative Team at MSU

Fall 2021 Member of Plant Biotechnology for Health and Sustainability Symposium organizing committee at MSU

Fall 2021 Member of Council of Graduate Students Finance Committee at MSU

Spring 2021 Semi-finalist in Science SLAM hosted by Museum of Science in Boston
(<https://www.youtube.com/watch?v=V-gVdP7SqXA&t=388s>)

Brian Charles Clark (2020), A WSU Scientist Explores the Ecological and Evolutionary Power of Symbiosis, <https://magazine.wsu.edu/2020/10/31/get-together/> (**Press coverage regarding my research**)

Folta K, **Roberts M**, Farre E (2020) Circadian clocks,
<http://www.talkingbiotechpodcast.com/249-circadian-clocks/> (**podcast interview**)

Roberts M, Jensen A, Coker H, Dimitrov A (2020) The Limit of Hospital Bed Availability due to COVID-19 spread in Washington, <https://youtu.be/SYmI-PK7sIE> (**8-minute video**)

Roberts M (2019) Playing with Bacteria: An Undergrad Science Story, Encounter Research Series, WSUV (**45-minute research talk for general audience**)

Lindman S (2019) Student's paper on antibiotic resistance receives 2019 Library Research Award, WSU Insider, <https://news.wsu.edu/2019/05/14/students-paper-antibiotic-resistance-receives-2019-library-research-award/> (**Press coverage regarding my research**)

Kimball M (October 15th, 2019) Vancoug Explores the Dangers of Antibiotic-Resistance, Vancougar News Magazine, <http://thevancougar.com/vancoug-explores-the-dangers-of-antibiotic-resistance/> (**Press coverage regarding my research**)

Poster Presentations

Roberts M, Jensen A, Coker H, Dimitrov A (2020) Selectively Caring for the Most Severe COVID-19 Cases Will Delay a Hospital Bed Shortage in Washington, WSUV

Roberts M, Porter S, Soil bacteria adapt to tolerate heavy metal stress in their local soil environment

- 2020 WSUV Undergraduate Research Showcase
- 2019 Murdock College Science Research Conference
- 2019 WSU Plant Sciences Symposium
- 2019 WSU Symposium for Undergraduate Research and Creative Activities
- 2019 WSUV Undergraduate Research Showcase

Research Skills

Programming

- Bash: building custom scripts and computational biology workflows
- R: mixed models, phylogenetics
- Python: Biopython, custom BLAST searches, manipulating genomes and motifs
- Perl: bioperl, manipulating sequence data
- C++: basic function building
- Mathematica: analysis of differential equations
- LaTeX: formatting documents through Overleaf
- GitHub: <https://github.com/milesroberts-123>

Computational biology

- Using high-performance computing clusters
- Genome-wide association: univariate, multivariate, k-mer-based, and SNP-based methods
- Population genetics simulations: SLiM software
- 2D and 3D image analysis: extracting traits from images, sklearn, sci-kit image
- DNA-seq and RNA-seq analysis: trimming, alignment, clustering
- Surrogate variable analysis: controls for unknown technical covariates in gene expression data
- Calling, annotating, and filtering genetic variants: GATK, picardtools, snpEff, etc.
- Machine learning: WEKA software, supervised and unsupervised methods
- Cis-regulatory element identification: *de-novo* (MEME, DREME, HOMER, etc.) and homology-based (FIMO, etc.) methods
- Sequence alignment and phylogeny construction: MEGA software, MAFFT, etc.

Laboratory Techniques

- Measuring bacterial growth curves
- Isolating viruses from soil
- Determining minimum inhibitory concentrations of heavy metals
- DNA extraction
- Polymerase chain reaction
- Gel electrophoresis