

CURRICULUM VITAE - J. Dylan Shropshire May 2020

CONTACT INFORMATION

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EDUCATION

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| 2020 | <i>Ph.D.</i> in Biological Sciences
Vanderbilt University, Nashville, TN
<i>Dissertation title:</i> "Identification and Characterization of the Genetic Basis of <i>Wolbachia</i> -induced Cytoplasmic Incompatibility"
<i>Committee:</i> Antonis Rokas, Jared Nordman, Ann Tate, Borden Lacy
<i>Advisor:</i> Seth R. Bordenstein |
| 2015 | <i>B.S.</i> in Biological Sciences, <i>magna cum laude</i>
East Tennessee State University, Johnson City, TN |

RESEARCH EXPERIENCE

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| Present-2017 | <i>NSF Graduate Research Fellow</i>
Vanderbilt University, Nashville, TN
Doctoral candidate in Dr. Seth R. Bordenstein's lab studying the genetic basis of reproductive parasitism in the tripartite interaction between insects, bacteria, and viruses. Techniques utilized include insect husbandry, transgenesis, microscopy, comparative genomics, DNA/RNA extractions, PCR/qRT-PCR, gel electrophoresis, Sanger sequencing, and statistical analysis. |
| 2015-2016 | <i>Ph.D.</i> Student
Vanderbilt University, Nashville, TN
Doctoral student in Dr. Seth R. Bordenstein's lab studying the role of the microbiome on parasitoid wasps. Techniques utilized in these studies included germ-free rearing, Sanger sequencing, video recording, behavioral analysis, statistical analysis, and bacterial culture. |
| 2015-2013 | <i>CRAWL Undergraduate Research Fellow</i>
East Tennessee State University, Johnson City, TN
Collaborative Research on the Arthropod Way of Life (CRAWL) research fellow in the labs of Dr. Karl Joplin, Dr. Darrel Moore, and Dr. Edith Seier studying the social context of behavioral development in flesh flies. Techniques included insect husbandry, video recording and analysis, behavior scoring, and behavioral analysis using Noldus Observer XT. |
| 2015-2014 | <i>Curator of ETSU Insect Museum</i>
East Tennessee State University, Johnson City, TN
Curated a private insect collection expanded yearly by students in an Entomology course. Responsibilities included organizing insects into taxonomic groups, inspecting for damage, replacing moth ice, and labeling specimens. |

2015-2014 *Undergraduate Lab Assistant*
East Tennessee State University, Johnson City, TN
Lab assistant under Dr. Karl Joplin. Responsibilities included insect stock maintenance, cleaning of lab spaces, and organization.

RESEARCH PRODUCTS

Students mentored^{}; Co-first authorships[#]; Corresponding authors[†]*

In Preparation

- **Shropshire, J.D.[†]**, Kalra, M.[#], & Bordenstein, S.R.[†] (Preprint; in review). Cif genotypes and cytoplasmic incompatibility phenotypes: impacts on strain (in)compatibilities and penetrance. *BioRxiv*, 2020.05.13.093815.
- Pugazenthi, S.^{*}, White, P.^{*}, Basu, A.^{*}, Chandrashekar, A.^{*}, & **Shropshire, J.D.[†]** (In review). Survey of *Wolbachia* prevalence in Nashville, Tennessee reveals novel infections.
- **Shropshire, J.D.[†]**, Rosenberg, R.[#], & Bordenstein, S.R.[†] (In review). Cif genotypes and cytoplasmic incompatibility phenotypes: impacts on strain (in)compatibilities and penetrance.

Research Articles

- Layton, E.M.^{*}, On, J.^{*}, Perlmutter, J., & Bordenstein, S.R.[†] & **Shropshire, J.D.[†]** (2019). Paternal grandmother age affects the strength of *Wolbachia*-induced cytoplasmic incompatibility in *Drosophila melanogaster*. *mBio*. 10(6).
- **Shropshire, J. D.[†]**, & Bordenstein, S. R.[†] (2019). Two-By-One model of cytoplasmic incompatibility: Synthetic recapitulation by transgenic expression of *cifA* and *cifB* in *Drosophila*. *PLOS Genetics*. 16(6), e1008221
- **Shropshire, J. D.[†]**, On, J.^{*}, Layton, E. M.^{*}, Zhou, H.^{*}, & Bordenstein, S. R.[†] (2018). One prophage WO gene rescues cytoplasmic incompatibility in *Drosophila melanogaster*. *Proceedings of the National Academy of Sciences*, 115(19), 4987-4991.
- LePage, D. P. [#], Metcalf, J. A. [#], Bordenstein, S. R., On, J.^{*}, Perlmutter, J. I., **Shropshire, J. D.**, Layton, E.M.^{*}, Funkhouser-Jones, L. J., Beckmann, J.F., & Bordenstein, S. R.[†] (2017). Prophage WO genes recapitulate and enhance *Wolbachia*-induced cytoplasmic incompatibility. *Nature*, 543(7644), 243-247.
- **Shropshire, J. D.^{†, #}**, van Opstal, E. J.[#], & Bordenstein, S. R. [†] (2016). An optimized approach to germ-free rearing in the jewel wasp *Nasonia*. *PeerJ Preprints*, 4, e2088v1.
- **Shropshire, J.D.**, Moore, D., Seier, E., & Joplin, K. H.[†] (2015). Male aggression, limited female choice and the ontogeny of mating behaviour in the flesh fly *Sarcophaga crassipalpis*. *Physiological Entomology*, 40(4), 325-335.
- Moore, D., Paquette, C., **Shropshire, J. D.**, Seier, E., & Joplin, K. H.[†] (2014). Extensive reorganization of behavior accompanies ontogeny of aggression in male flesh flies. *PloS one*, 9(4), e93196.

Other Articles

- **Shropshire, J. D.[†]**, Leigh, B., Bordenstein, S. R., Duploux, A., Riegler, M., Brownlie, J. C., & Bordenstein, S. R.[†] (2019). Models and Nomenclature for Cytoplasmic Incompatibility: Caution over Premature Conclusions-A Response to Beckmann *et al.* *Trends in genetics: TIG*.
- **Shropshire, J. D.** & A. Rokas[†] (2017). Heredity: The gene family that cheats Mendel. *eLife* 6: e28567.

- Dittmer, J., van Opstal, E. J., **Shropshire, J. D.**, Bordenstein, S. R., Hurst, G. D., & Brucker, R. M.[†] (2016). Disentangling a holobiont—recent advances and perspectives in *Nasonia* wasps. *Frontiers in Microbiology*, 7.
- **Shropshire, J. D.**[†], & Bordenstein, S. R.[†] (2016). Speciation by symbiosis: The microbiome and behavior. *mBio*, 7(2), e01785-15.

Patents

S.R. Bordenstein and **J.D. Shropshire** (2019) “Methods of Cytoplasmic Incompatibility-Based Transgenics for Pest or Vector Control” (Provisional Patent). Attorney Docket Number 10644-064PV1. Application number 62/655,389. VU18134. Equal inventorship.

Invited Seminars

- **Shropshire, J. D.**, & Bordenstein, S. R. (2019). The simple genetic basis of cytoplasmic incompatibility. Animal-microbe symbiosis Gordon Research Seminar. West Dover, VT. (Full travel support)
- **Shropshire, J. D.**, & Bordenstein, S. R. (2019). Identifying bacteriophage genes that manipulate arthropod reproduction. *Austin Peay State University*. Clarksville, TN. (Full travel support)
- **Shropshire, J. D.**, & Bordenstein, S. R. (2019). Identifying bacteriophage genes that manipulate arthropod reproduction. *North Carolina State University*. Raleigh, NC. (Partial travel support)

National/International Presentations

- **Shropshire, J.D.**, & Bordenstein, S. R. (2020). Characterizing bacteriophage proteins that hijack arthropod reproduction. The Allied Genetics Conference 2020. Online. Poster.
- **Shropshire, J.D.**, & Bordenstein, S. R. (2019). Identifying and characterizing phage genes that control arthropod reproduction. Entomology 2019. St. Louis, MO. Talk. 2nd place speaking award.
- **Shropshire, J.D.**, & Bordenstein, S. R. (2019). The simple genetic basis of cytoplasmic incompatibility. Animal-microbe symbiosis Gordon Research Seminar & Conference. West Dover, VT. Poster
- **Shropshire, J.D.**, & Bordenstein, S. R. (2019). Discover the Microbes Within! The Wolbachia Project. Undergraduate Biology Education Research Gordon Research Seminar & Conference. West Dover, VT. Poster
- **Shropshire, J.D.**, & Bordenstein, S. R. (2018). A single prophage WO gene rescues cytoplasmic incompatibility. *Wolbachia Conference 2018*. Salem, MA. Talk.
- **Shropshire, J.D.**, & Bordenstein, S. R. (2018). One prophage WO gene rescues cytoplasmic incompatibility in *Drosophila melanogaster*. *Drosophila Conference 2018*. Philadelphia, PA. Talk.
- **Shropshire, J.D.**, Moore, D., Seier, E., & Joplin, K. H. (2014) Effect of social environment on flesh fly behavior. *Entomological Society of America*. Portland, OR. Talk.

Regional Presentations

- **Shropshire, J.D.**, & Bordenstein, S. R. (2019) Identifying phage genes that control insect reproduction. Entomological Society of America Southeast Branch Meeting. Mobile, AL. Talk. 1st place speaking award.
- **Shropshire, J.D.**, Metcalf, J., Perlmutter, J., LePage, D., On, J., Layton, E. M.^{*}, Zhou, H.^{*}, & Bordenstein, S. R. (2018). Phage genes control bacterial-induced inviability in insects. *American Society for Microbiology Southeastern branch meeting 2018*. Atlanta, GA. Poster.

- **Shropshire, J.D., & Bordenstein, S. R. (2018).** A single prophage WO gene rescues bacterial-induced infertility in *Drosophila*. *Tennessee Academy of Sciences 2018*. Clarksville, TN. Talk. 1st place speaking award.
- **Shropshire, J.D., & Bordenstein, S. R. (2018).** A single prophage WO gene rescues bacterial-induced infertility in *Drosophila*. *American Society for Microbiology KY-TN branch meeting 2018*. Murfreesboro, TN. Talk. 3rd place speaking award.
- **Shropshire, J.D., Moore, D., Seier, E., & Joplin, K. H. (2014)** Mating in the flesh fly. *Boland Undergraduate Research Symposium*. Johnson City, TN. Talk.

Institutional Presentations

- **Shropshire, J.D., Metcalf, J., Perlmutter, J., LePage, D., On, J., Layton, E. M.*, Zhou, H.*, & Bordenstein, S. R. (2019).** Phage genes control bacterial-induced inviability in insects. *Vanderbilt Institute for Infection, Immunology, and Inflammation Symposium*. Nashville, TN. Poster.
- **Shropshire, J.D., & Bordenstein, S. R. (2019).** Identifying and characterizing the genes that control animal reproduction. *Vanderbilt Microbiome Initiative*. Nashville, TN, Talk.
- **Shropshire, J.D., & Bordenstein S.R. (2018)** On the genetic basis of bacterial-induced inviability in *Drosophila*. *Vanderbilt BioSci Research in Progress*. Nashville, TN. Talk.
- **Shropshire, J.D., & Bordenstein, S. R. (2018).** The genetic basis of Wolbachia-induced cytoplasmic incompatibility. *Vanderbilt SuperFly Meeting*. Nashville, TN, Talk.
- **Shropshire, J.D., On, J., Layton, E., Zhou, H., & Bordenstein S.R. (2018)** A single prophage WO gene rescues cytoplasmic incompatibility. *Vanderbilt Institute for Infection, Immunology, and Inflammation Symposium*. Nashville, TN. Poster.
- **Shropshire, J.D., & Bordenstein S.R. (2018)** A single prophage WO gene rescues cytoplasmic incompatibility. *Vanderbilt BioSci Annual Retreat*. Nashville, TN. Talk.
- **Shropshire, J.D., LePage, D., Perlmutter, J., On, J.*, Layton, E.*, & Bordenstein S.R. (2017)** A single gene contributes to and prevents embryonic lethality induced by a bacterial symbiont. *Vanderbilt BioSci Annual Retreat*. Nashville, TN. Poster.

GRANTS RECEIVED

2022-2017	National Institutes of Health, R01, "The Genetic Basis of Cytoplasmic Incompatibility", <i>Coauthor</i> : \$1,951,071 (total), \$1,250,000 (direct costs), \$707,071 (indirect costs)
2019	American Society for Cell Biology COMPASS Outreach Grant. <i>Co-PI</i> : \$200 (direct costs)
2018	American Society for Cell Biology COMPASS Outreach Grant. <i>Co-PI</i> : \$300 (direct costs)
2020-2017	National Science Foundation, Graduate Research Fellowship Program. \$102,000 (stipend/3yr), \$36,000 (Cost of education/3yr)
2013	ETSU Honors College Student Faculty Collaborative Research Grant. <i>Coauthor</i> : \$600 (direct costs)

HONORS & AWARDS

2019	Entomology 2019 Speaking Award (2 nd place)
2019	Graduate Student Research Excellence Award, Vanderbilt University
2019	Animal-Microbe Gordon Research Conference Speaking Scholarship
2019	Undergraduate Biology Education Research Gordon Research Conference Scholarship
2019	Entomological Society for America SEB Speaking Award (1 st place)

2019	Vanderbilt University Graduate Student Travel Award
2018	Vanderbilt University Graduate Student Travel Award
2018	Tennessee Academy of Sciences Speaking Award (1 st place)
2018	American Society for Microbiology KY-TN Speaking Award (3 rd place)
2017	NSF Graduate Research Fellowship Awarded
2017	Ann Bernard Martin Award for Excellence in Graduate Research
2016	NSF Graduate Research Fellowship Program Honorable Mention
2014	Collaborative Research on the Arthropod Way of Life Travel Award
2014	ETSU Biological Sciences Outstanding Senior of the Year Award
2014	ETSU Biology Department Travel Award
2014	ETSU Honors College Travel Award

COURSES TAUGHT

2019-2017	<p><i>Co-Advisor: Directed Research (BSCI 3861)</i> Vanderbilt University, Nashville, TN Supervised four undergraduate students undertaking semi-independent research projects. Priority was given to teaching experimental design, project management, troubleshooting, data acquisition, data analysis, and manuscript preparation.</p>
2018-2017	<p><i>Instructor: Project-Focused Introduction to Biology Lab (BSCI 1512L)</i> Vanderbilt University, Nashville, TN Responsibilities included full curriculum design, implementation, and assessment. Students conducted a course-long project that involved the screening and description of arthropods infected with <i>Wolbachia</i>, a commonly found bacteria present in reproductive tissue. Techniques taught included arthropod collections and storage, identification of collected specimen, DNA extractions, PCR, gel electrophoresis, data analysis, poster design, presentation, and literature review. The Spring 2018 class has decided to attempt publishing their results in a peer-reviewed journal.</p>
2018	<p><i>Co-Instructor: Summer Academy at Vanderbilt for the Young (SAVY)</i> Programs for Talented Youth, Vanderbilt University, Nashville, TN Instructed a field ecology course for gifted 5th-6th grade students. Developed lessons to teach students how to identify arthropods, understand the role of insects in the environment, and how humans fit into our ecosystem. Lessons included numerous active learning techniques to keep students engaged, such as think-pair-share, jigsaw reading exercises, hands-on microscope activities, field exercises, among others.</p>
2016	<p><i>Teaching Assistant: Introduction to Biology Lab (BSCI 1511L)</i> Vanderbilt University, Nashville, TN Instructed a standard introduction to biology lab. Responsibilities included giving lecture-based instruction, providing demonstrations, assisting students, holding regular office hours, grading exams/homework/classwork, and connecting students to resources to get involved in research.</p>
2017	<p><i>Co-Advisor: Research Internship (BSCI 3860)</i> Vanderbilt University, Nashville, TN</p>

Facilitated a weekly meeting on assigned literature to prepare a student for the upcoming directed research course. The student then wrote a review on the reading and related articles, and was subsequently subjected to a pseudo-review process.

2014 *Genetics Tutor*
Student Support Services
East Tennessee State University, Nashville, TN
Met with students twice weekly to discuss content presented in their genetics lecture. Designed additional assessments to facilitate learning.

OUTREACH

Present-2018 *Science Club at the Library*
Funded by the American Society for Cell Biology and the Vanderbilt Microbiome Initiative. Science Club at the Library is a monthly event that brings Vanderbilt researchers to an audience of 4-10 year olds to teach them about science through activities and discussion. Topics have included sealion whisker anatomy, the human gut microbiome, viruses and disease, insect diversity, aquatic microbiology, and food microbiology. As a co-PI on the grants funding this effort, responsibilities have included organizing the venue, advertising, activity design, and assisting with instruction during events.

Present-2016 *Discover the Microbes Within! The Wolbachia Project*
The *Wolbachia* Project aims to bring entomology and molecular biology techniques into schools. Involvement has included presenting research to students at Hillsboro High School and Vanderbilt Academy for Science and Math, a question/answer session regarding how one becomes a graduate student, served as an invited speaker to discuss the *Wolbachia* Project at a teaching workshop organized by the Bay Area Biotechnology Education Consortium, assisted classrooms with insect identifications and DNA extractions, and assisted with the design of official course material for the project.

2019-2018 *Nearly 100 Years Since the Scopes Trial: Teaching Evolution in Tennessee*
Funded by the European Society for the Evolutionary Biology, this effort seeks to create a series of kits that can be provided to rural elementary and middle school classrooms to teach a variety of evolutionary principles. Responsibilities included helping to design a kit to teach students about the impact of reproductive strategies on evolutionary rates.

2019 *Nashville Science Club*
The Nashville Science Club is a diverse group of people including musicians, artists, retail workers, scientists, accountants, and others that are interested in learning more about science. I presented a talk entitled "*The bacteria that hijacks arthropod sex lives.*" I discussed how the bacteria *Wolbachia* is capable of manipulating its host's reproduction to favour its transmission and how it can be used to curb the spread of mosquito-borne diseases.

2018-2017 *MegaMicrobe*

Sponsored by the Vanderbilt Microbiology initiative and Vanderbilt Institute for Infection, Immunology, and Inflammation, MegaMicrobe is a yearly event that bring researchers together to create activities for K-6 students. These activities emphasize the importance of microbes in our world and highlight why researching them is necessary. Involvement has included two years of activity design and co-instruction.

- 2018-2017 *Skype-a-Scientist*
- Skype-a-Scientist matches scientists with classrooms around the world to give scientists an opportunity to translate their science and students a chance to learn of it. Involvement has included numerous skype sessions, one with Dr. Mark O. Martin's Microbiology class at the University of Puget Sound in Washington and another with a BioEngineering class at MESA Charter High School in New York.

MENTORSHIP

Postdoctoral trainees

- Brittany Leigh (2018): Postdoctoral researcher. Trained on *Drosophila* handling and genetics under my supervision.

Graduate students

- Maggie Grau (2017): MSTP rotation student assisting with experiments testing cytoplasmic incompatibility genes.

Undergraduate students

- Emily Layton (2016-Present): Vanderbilt Class of 2020; Coauthor on two papers identifying genes that cause and rescue cytoplasmic incompatibility: LePage et al. 2017 *Nature* and Shropshire et al. 2018 *PNAS*. Emily first authored an article published in *mBio* 2019. SyBBURE Searle undergraduate research fellow.
- Aakash Basu (2018-Present): Vanderbilt Class of 2021; Goldwater Scholar.
- Sangamithra Pugazenthi (2018-Present): Vanderbilt Class of 2020
- Phoebe White (2018-Present): Vanderbilt Class of 2021
- Mahip Kalra (2018-Present): Vanderbilt Class of 2022. SyBBURE Searle undergraduate research fellow.
- Rachel Rosenberg (2019): Vanderbilt Class of 2021
- Helen Zhou (2017-2018): Vanderbilt Class of 2018; Coauthor on the identification of genes that rescue cytoplasmic incompatibility: Shropshire et al. 2018 *PNAS*. Now a law student at Columbia Law School.
- Jungmin (Danny) On (2016-2017): Vanderbilt Class of 2016; Coauthor on two papers identifying genes that cause and rescue cytoplasmic incompatibility: LePage et al. 2017 *Nature*, Shropshire et al. 2018 *PNAS*, and Layton et al. 2019 *mBio*. Now a medical student at the Medical College of Georgia.
- Melissa Halstead (2016): Vanderbilt Class of 2019; Volunteered for a semester working on the influence of the microbiome on *Nasonia* wasps.
- Katie Carbonell (2016): Vanderbilt Class of 2019; Volunteered for a semester working on the influence of the microbiome on *Nasonia* wasps.

High school students

- Fiona Broadie (2016): Volunteered for a summer to learn how to rear *Nasonia* and dissect reproductive tissues.

ADDITIONAL EDUCATION

2019	Making figures in R for beginners, Vanderbilt University, Workshop
2019	Introduction to GitHub, Vanderbilt University, Workshop
2018	Certificate in College Teaching, Center for Teaching, Vanderbilt University
2017	Students as Research Collaborators: Managing Students & Resources, American Society For Microbiology, Webinar
2017	Peak performance: Work-life balance, Vanderbilt University, Workshop
2016	Making Sense of High-Throughput Gene Expression Data, CQS Summer Institute, Vanderbilt University, Certificate
2014	Noldus Observer XT, East Tennessee State University, Training

SERVICE

2019-2018	Communication Chair & Co-founder, American Society for Microbiology VU Student Chapter
2018-2017	Secretary of Education, Biological Sciences Graduate Student Association
2017-2016	Treasurer, Biological Sciences Graduate Student Association

Reviewed for: Proceedings of the Royal Society B, Molecular Genetics and Genomics, Young Scientist: A High School Research Journal.

PROFESSIONAL ASSOCIATIONS

Genetics Society of America
Insect Genetic Technologies Research Coordination Network
Entomological Society of America
Society for the Study of Evolution
American Society for Microbiology
Union of Concerned Scientists
American Academy for the Advancement of Science