

LIANA T. BURGHARDT

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Dept. of Plant Science
College of Agricultural Sciences
The Pennsylvania State University

APPOINTMENTS

Penn State University, University Park, PA, Dept. of Plant Sciences starting Feb. 2020

- Assistant Professor in College of Agricultural Sciences
- Dorothy Foehr Huck and J. Lloyd Huck Early Career Chair

EDUCATION

University of Minnesota, Twin Cities, Plant and Microbial Biology Summer 2015-present

- Post-doctoral researcher in the lab of **Dr. Peter Tiffin**

Duke University, Durham NC, Department of Biological Sciences Fall 2009- Spr. 2015

- PhD in Biology in the lab of **Dr. Kathleen Donohue**
- Dissertation: The Influence of Genetic and Environmental Factors on the Phenology and Life-Cycle Expression of *Arabidopsis thaliana*, Certificate in College Teaching

Brown University, Providence, RI Aug. 2007- Aug. 2009

- Post-baccalaureate research technician in lab of **Dr. Johanna Schmitt**

Carleton College, Northfield, MN Fall 2003- Spr. 2007

- B.A. Spring 2007, Magna Cum Laude, Sigma Xi, Phi Beta Kappa
- Major: Biology; Concentration: Environment and Technology Studies

EXTERNAL FUNDING

Current

- NSF-RESEARH-PGR: Genomics of strain- and host-specific performance in the legume-rhizobia symbiosis
PI-Tiffin, co-PI's Burghardt, Sadowsky, Heath, Yakub, & Young \$1,700,000
- DOE-Community Sequencing Project funded through Joint Genome Institute
PI-Tiffin, co-PI's Burghardt, Sadowsky, Heath, & Young

Past

- RESEARH-PGR: Leveraging the Medicago HapMap to characterize genome-by-genome interactions in nitrogen-fixing symbiosis
PI-Tiffin, co-PI's Burghardt, Sadowsky, Heath, Yakub, & Young \$550,000
- NSF Doctoral Dissertation Improvement Grant (2013-2015) \$20,412

AWARDS

External Fellowships & Honors

- Short-listed for Tansley Medal for Excellence in Plant Science (Winter 2019)
- NSF Pre-Doctoral Fellowship (Fall 2009- Spring 2014) \$126,000
- BioBass Teaching Fellowship (Spring 2015) \$11,000
- James B. Duke Fellowship (Fall 2009-Spring 2012) \$20,000

Travel Grants & Internal Awards

- CBS “Most Impactful” Research Award (Winner 2018, Honorable Mention, 2017) \$150
 - Plant and Microbial Biology best poster award (Spring 2017) \$50
 - Microbial & Plant Gen. Travel Grant (Spring 2015, 2016, 2017, 2019) \$1900
 - Postdoctoral Association Travel Grant (Spring, 2017) \$400
 - Preparing Future Faculty Fellow (Fall 2014-Spring 2015) \$500
 - Pathfinder Fellow (Fall 2014) \$1500
 - Travel Award to attend International Society for Seed Scientists (2013) \$300
 - American Society of Naturalists Travel Grant (2012) \$500
 - NSF International Travel Fund (2011) \$1,000
 - Adelaide H. Matteson Service Internship (2005) \$4,000
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PUBLICATIONS

2019

L. T. Burghardt*, D. Trujillo* B. Epstein, P. Tiffin, and N. D. Young. Select-and-resequence screening reveals rhizobia strain-specific effects of nodule-specific PLAT domain genes in *Medicago truncatula*. ***Plant Physiology*** (*in press*).

*equal contribution

L. T. Burghardt. Evolving together, evolving apart: Measuring the fitness of rhizobial bacteria in and out of symbiosis with leguminous plants. 2019. ***New Phytologist***. doi:10.1111/nph.16045 (*Tansley Insight* entry for Tansley medal)

L. T. Burghardt, Brendan Epstein, P. Tiffin. 2019 Legacy effect of prior host genotype and soil selection on rhizobial mutualist fitness *in planta*. ***Evolution***. 73: 2013-2023. doi:10.1111/evo.13807

B. J. Tomasek, **L. T. Burghardt**, and R. K. Shriver. Filling in the gaps in survival analysis: inferring time-varying responses to environment from interval-censored field data. ***Ecology***. e02778. doi: 10.1002/ecy.2778

Gorton, A. J., **Burghardt, L. T.** and Tiffin, P., Adaptive evolution of plant life history in urban environments. In: **Urban Evolutionary Biology**. Edited by M. Szulkin, J. Munshi-South and A. Charmantier: Oxford University Press (2020) doi:10.1093/oso/9780198836841.003.0009

2018

L. T. Burghardt, B. Epstein, J. Guhlin, M. Nelson, M. Sadowsky and P. Tiffin. 2018. Select and resequence reveals relative fitness of bacteria in symbiotic and free-living environments. *Proceedings of the National Academy of Sciences*. doi: 10.1073/pnas.1714246115

Brendan Epstein, Reda Abou-Shanab, Abdelaal Shameldsin, Margaret Taylor, Joseph Guhlin, **L. T. Burghardt**, Matthew Nelson, Michael Sadowsky, and Peter Tiffin. Genome-wide association analyses in the model rhizobium *Ensifer meliloti*. *mSphere*. doi: 10.1128/mSphere.00386-18

2017

L. T. Burghardt, J. Guhlin, P. Zhou, J. Liu, R. Stupar, N. D. Young, P. Tiffin. 2017. Transcriptomic basis of genome-by-genome variation in a legume-rhizobia mutualism. *Molecular Ecology*. doi: 10.1111/mec.14285 (*Highlighted in a Perspective*)

B. Edwards, **L. T. Burghardt**, K. Kovach, and K. Donohue. 2017. Canalization of seasonal phenology in the presence of developmental variation: Seed dormancy cycling in an annual weed. *Integrative and Comparative Biology* doi: 10.1093/icb/ix065 (*Special Issue: Evolutionary Impacts of Seasonality*)

L. T. Burghardt, N. D. Young, P. Tiffin. 2017. A guide to genome-wide association studies (GWAS) in plants. *Current Protocols in Plant Biology*. 2:22-38. doi: 10.1002/cppb.20041

L. T. Burghardt and C. J. E. Metcalf. 2017. The evolution of senescence in annual plants: the importance of phenology and the potential for plasticity. *The Evolution of Senescence across the Tree of Life*. Eds: R. P. Shefferson, O. Jones, R. Salguero-Gómez. 284-302. doi: 10.1017/9781139939867.014

A. Waters, I. Makarevitch, J. Noshay, **L. T. Burghardt**, C. Hirsch, C. Hirsch, and N. Springer. 2017. Natural variation for regulation of gene expression responses to abiotic stress in maize. *The Plant Journal*. 89: 707-717 doi:10.1111/tbj.13414

S. J. Curtin, P. Tiffin, J. Guhlin, P. Atkins, N. J. Baltus, **L. T. Burghardt**, R. Denny, D. F. Voytas, R. M. Stupar, and N. D. Young 2017. Validating genome-wide association candidates: selecting, testing, and characterizing genes that control quantitative variation in rhizobial nodulation. *Plant Physiology*. doi:10.1104/pp.16.01923

2016

L. T. Burghardt, D. E. Runcie, A. M. Wilczek, M. D. Cooper, J. L. Roe, S. M. Welch, and J. Schmitt. 2016. Fluctuating, warm temperatures decrease the effect of a key floral repressor on flowering time in *Arabidopsis thaliana*. *New Phytologist*. 210: 564–576. doi:10.1111/nph.13799

L. T. Burghardt, C. J. E. Metcalf, and K. Donohue 2016. A cline in seed dormancy helps conserve the environment experienced during reproduction across the range of *A. thaliana*. *American Journal of Botany*. 103: 47-59. doi:10.3732/ajb.1500286

L. T. Burghardt, B. Edwards, and K. Donohue. 2016. Multiple paths to similar germination behavior in *Arabidopsis thaliana*. *New Phytologist*. 209: 1301-1312. doi:10.1111/nph.13685

Edwards B. R., **L. T. Burghardt**, M. Zapata-Garcia, and K. Donohue. 2016. Maternal temperature effects on dormancy influence germination responses to water availability in *Arabidopsis thaliana*. ***Environmental and Experimental Botany***. 126: 55-67. doi:10.1016/j.envexpbot.2016.02.011

2015

L. T. Burghardt, C. J. E. Metcalf, A. Wilczek, J. Schmitt, and K. Donohue. 2015. Modeling the influence of genetic and environmental variation on the expression of plant life cycles across landscapes. ***American Naturalist***. 185: 212-227. doi:10.1086/679439

K. Donohue, **L. T. Burghardt**, D. Runcie, K. J. Bradford and J. Schmitt. 2015. Applying developmental threshold models to evolutionary ecology. ***Trends in Ecology and Evolution*** 30: 66-77. doi:10.1016/j.tree.2014.11.008

C. J. E. Metcalf, **L. T. Burghardt**, and D. Koons. 2015. Avoiding the crowds: the evolution of plastic responses to seasonal cues in a density dependent world. ***Journal of Ecology*** 103: 819-828. doi:10.1111/1365-2745.12391

G. A. Auge, L. K. Blair, **L. T. Burghardt**, J. Coughlan, B. Edwards, L. D. Leverett, K. Donohue. 2015. Secondary dormancy induction depends on primary dormancy status in *Arabidopsis thaliana*. ***Seed Science Research*** 25: 230-246. doi: 10.1017/S0960258514000440

Earlier

C. Zhang, C. G. Willis, **L. T. Burghardt**, W. Qi, K. Liu, P. Filho, Z. Ma, and G. Du. 2014. The community-level effect of light on germination timing in relation to seed mass: a source of regeneration niche differentiation. ***New Phytologist*** 204: 496-506. doi: 10.1111/nph.12955

C. G. Willis, C. C Baskin, J. M Baskin, J. R Auld, D.L Venable, C, J. Cavender-Bares, K. Donohue, R. R. de Casas, K. Bradford, **L. T. Burghardt**, S. Kalisz, S. Meyer, J. Schmitt, S. Strauss, and A. Wilczek. 2014. The evolution of seed dormancy: Environmental cues, evolutionary hubs, and diversification of the seed plants. ***New Phytologist***. 203: 300 -309. doi: 10.1111/nph.12782

K. Donohue, R. Rubio de Casas, **L. T. Burghardt**, K. Kovach, and C. G. Willis. 2010. Germination, post-germination adaptation, and species ecological ranges. ***Annual Review of Ecology and Systematics*** 41: 293-319. doi: 10.1146/annurev-ecolsys-102209-144715

A. M. Wilczek, **L. T. Burghardt**, A R. Cobb, M. D. Cooper, S. M. Welch, and J. Schmitt. 2010. Genetic and physiological bases for phenological responses to current and predicted climates. ***Philosophical Transactions of the Royal Society B***. 365: 3129-3147. doi: 10.1098/rstb.2010.0128

INVITED PRESENTATIONS

- June 2019 **Spotlight Session at Evolution Meeting**—“Origins, stability, and benefits of interspecific cooperation in a changing world”. Providence Rhode Island.
- Mar. 2019 **University of Massachusetts**. Amherst, MA

Feb. 2019	University of Arizona. Tuscan, AZ
Feb. 2019	Cornell University. Ithaca, NY
Jan. 2019	Penn State University. Happy Valley, Pennsylvania
Nov. 2018	Carleton University. Ottawa, Canada
Sept. 2018	Young Microbiologist Symposium. John Innes Center, Norwich, England
Sept. 2018	Carleton College. Northfield, Minnesota—undergraduate audience
Aug. 2018	Symposium organizer for II Joint Congress on Evolutionary Biology. Parasite and symbiont niches: host specificity and beyond. Montpellier, France.
Mar. 2018	UW Crow Early Career Seminar Series. Madison, Wisconsin
Mar. 2018	University of Massachusetts. Boston, MA
Feb. 2018	University of Wyoming. Laramie, WY
Feb. 2018	University of Illinois. Chicago
Jan. 2018	University of Alaska. Anchorage
Oct. 2017	Duke Population Biology Seminar Series. Durham, NC.
Nov. 2016	University of Pennsylvania Ecology Seminar Series. Philadelphia
Sept. 2016	Medicago Genetics and Genomics Workshop. Noble Fdn., Ardmore, OK
Sept. 2016	Plant Biology Seminar. St. Paul, Minnesota
Aug. 2015	European Society for Evolutionary Biology (ESEB). Lausanne, Switzerland
Feb. 2015	Christopher Newport University. Newport News, VA—undergraduate audience
May 2014	UMN Evoltwin Seminar. St. Paul, MN
Feb. 2014	UVA EEB Dept. Seminar. Charlottesville, VA
July 2013	International Workshop on Seed Science. Paris, France

CONTRIBUTED ORAL PRESENTATIONS

June 2017	Evolution Meeting, Portland OR
June 2016	Evolution Meeting, Austin, TX
Nov. 2014	Evolutionary Demography Society Meeting, Palo Alto, CA
Aug. 2014	Ecological Society of America (ESA), Sacramento, CA
June 2014	Evolution Meeting, Raleigh, NC
Jan. 2014	American Society of Naturalists Conference, Asilomar, CA
Dec. 2012	Duke University Women in Science Symposium, Durham, NC
June 2012	Evolution Meeting Ottawa, Canada.
June 2010	Evolution Meeting Portland, OR.
Oct. 2008	Northeastern Phenotypic Plasticity and Evolution (NEPPE), New York, NY

CONTRIBUTED POSTER PRESENTATIONS

Aug. 2018	II Joint Congress on Evolutionary Biology, Montpellier, France.
June 2018	Dynamic Plant Systems (Molecular Plant Biology), Gordon Research Conf.
June 2017	Evolution Meeting, Portland OR
July 2014	Unifying Ecology Across Scales: Gordon Research Conference, Biddeford, ME
Oct. 2012	Southeast Population, Ecology, and Evolutionary Genetics, Clemson, SC
Aug. 2012	Ecological Society of America (ESA) Portland, OR
Sept. 2008	iPlant, presented by Stephen Welch
July 2008	International Conference on Arabidopsis Research, Montreal, Canada
Aug 2006	U. of Delaware Undergraduate Research Symposium, Newark, DE

TEACHING/MENTORSHIP

Development:

Preparing Future Faculty Fellow (mentor at Guilford College) Fall 2014-Spring 2015
Certificate in College Teaching 2011-2015

Instructor of Record:

Topics in Evolutionary Ecology: Extreme Life Styles Spring 2015

Teaching Assistant:

Organismal Responses to Climate Change Fall 2014
Genetics Lab, Carleton College, two terms Fall 2006-Spring 2007

Guest Lectures:

- Exploring the genetic basis of yeast biofilms using expression profiles, 12-hour bioinformatics module in R for college sophomores, Duke- Spring 2014
- Genotype x Environment interactions and organismal responses to climate change, Kathleen Donohue, Duke University- Spring 2012, Spring 2013, Fall 2014
- Topics in Simulation Modeling, Stephen Welch, Kansas State University- Fall 2012

Mentoring:

Sponsor for LSRP Postdoc Fellowship application (Indian female applicant) Fall 2019
Mentor for an NSF Research Experience for Teachers Summer 2019
UMN undergraduate researchers (4, 3 women) since Spring 2017
Research Technician Winter-Summer 2017
Howard Hughes undergraduates Summer 2011, 2012
Project SEED- high school students from under-represented minorities Summer 2010
Duke Undergraduates- one to three a semester Fall 2009-Fall 2014
Research Technician- mentored through writing first publication Spring 2012-2017

Teaching Outreach:

Developed and implemented Market Science curriculum on Plants-Microbes Fall 2018
Legume-Rhizobia module used in local high school classroom Fall 2017
Volunteer for Market Science since Summer 2015
Judge for World Food Prize Global Youth Institute Spring 2017
Developed module for teaching 8th graders how humans use plant defenses Spring 2014
Judge for local science fairs 2011-2013, 2015, 2016

SKILL SETS

Experimental: Design of randomized, manipulative field and lab experiments; DNA and RNA extraction; Environmental monitoring; Sterile technique, culturing, and phenotyping bacteria; Plant phenotypic measurements and care; Mutant analyses; Tissue sectioning and microscopy

Statistical tools: Generalized linear models (GLM) including mixed models (GLMM); Survival analyses; Principal component/coordinate analysis; Redundancy analysis; Permutation tests; Using AIC for model selection and comparison; GWAS; hierarchical clustering analysis; co-expression analysis (WCGNA)

Bioinformatic tools: R/Python/Unix programming environments; text and file manipulation with regular expressions; pipeline construction; Running jobs on remote clusters; Read alignment; DEseq; Haplotype reconstruction methods, MAXENT

Data types: Plant and bacterial genomes and transcriptomes; Poolseq; genomic variants (SNPs, haplotypes, presence/absence variants); Diverse organismal traits (physiological, life history, metabolic, stress tolerance, survival and fecundity); Environmental time series; BioClim variables

Modeling: Individual and population-based modeling; Gene pathway analyses; Photothermal modeling of growth and development

SERVICE

Reviewer for:

PNAS
Molecular Ecology
American Naturalist
E-life (Early career pool)
Ecology Letters
Functional Ecology
Ecology
New Phytologist
American Journal of Botany
Evolutionary Ecology
Annals of Botany
Seed Science Research
Scientific Reports
Biological Reviews
J. of the Royal Society Interface
Plants
PLOS Genetics
Int. Journal of Plant Sciences

Molecular Ecology Resources

ad hoc Grant Reviewer:

USDA-NIFA
NSF-IEP
NSF-DEB

Departmental:

Plant Biology Retreat Judge (2016)
Duke Biology Holiday Party Czar (2010 & 2014)
PopBio Seminar Czar (Fall 2012-Spring 2013)
PopBio Speaker Host (Spring 2011)
Women in Science Coordinator (2010-2011)
Biology Grad Recruitment (2010)
Pig-Picking Czar (2009)

OTHER PROFESSIONAL EXPERIENCE

Undergraduate Research in **Dr. Susan Singer's Lab**, Carleton College August 2006- May 2007
NSF REU in **Dr. Janine Sherrier's Lab**, University of Delaware June 2006- August 2006
Internship at **Center for Energy and Env. Policy**, Univ. of Delaware June 2005- August 2005

REFERENCES

Dr. Peter Tiffin-

Professor at University of Minnesota, Twin Cities ptiffin@umn.edu - 612-624-7406

Dr. Kathleen Donohue-

Professor at Duke University k.donohue@duke.edu - 919-684-6095

Dr. Johanna Schmitt-

Professor at Univ. of California, Davis jschmitt@ucdavis.edu - 530-752-2992

Liberal arts perspective:

Dr. Mark McKone-

Professor at Carleton College, Minnesota mmckone@carleton.edu - 507-222-4393

Additional:

Dr. Stephen Welch-

Professor at Kansas State University welchsm@ksu.edu - 785-532-7236

Dr. C. Jessica W. Metcalf-

Assistant Professor at Princeton Univ. cmetcalf@princeton.edu - 609-258-9649