

RACHEL M. PENCZYKOWSKI

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RESEARCH INTERESTS AND APPROACHES

I study effects of ecosystems on infectious diseases, and effects of diseases on ecosystems.
My research integrates concepts from population, community, and evolutionary ecology.

Questions that I'm particularly interested in include:

1. How does **winter climate** affect the viability of parasites with environmental stages? What are the effects of winter conditions on **(a)** spatial and temporal patterns of disease prevalence, **(b)** the genetic diversity and traits of hosts and parasites, and **(c)** host–parasite coevolution?
2. How do parasites drive **flows of energy & nutrients** through food webs and ecosystems?

To address these questions, I study **natural populations** of common **herbaceous plants** and their **fungal pathogens** across variation in environmental conditions, including winter climate.

My research involves a combination of modeling approaches, field observations, field experiments, greenhouse studies, laboratory assays, and molecular analyses.

EMPLOYMENT

Assistant Professor Sept 2017 – Present
Department of Biology
Washington University in St. Louis (Wash. U.), MO, USA

Postdoctoral Research Associate April 2016 – Aug 2017
Department of Integrative Biology
University of Wisconsin, Madison (UW-Madison), WI, USA
Advisor: Anthony R. Ives

Postdoctoral Researcher Oct 2013 – April 2016
Metapopulation Research Centre
University of Helsinki, Finland
Advisor: Anna-Liisa Laine

EDUCATION

Ph.D. in Biology 2008 – 2013
Georgia Institute of Technology (Georgia Tech), Atlanta, GA, USA
Advisor: Meghan A. Duffy
Dissertation: “Interactions between ecosystems and disease in the plankton of freshwater lakes”
Minor: Quantitative Ecology

B.S., with Distinction 2003 – 2007
University of Wisconsin, Madison, WI, USA
Majors: Biology and Music Performance
Research Advisor: Stephen R. Carpenter

GRANTS

- Living Earth Collaborative (\$22,775), Working group: Quantifying effects of parasites on ecosystem nutrient cycling. Lead PI: Amanda M. Koltz. **Co-PIs: R. M. Penczykowski, Vanessa O. Ezenwa, Sharon L. Deem.** 2018-2020
- InCEES (\$30,000), Title: Does climate change affect the interplay between soil microbes and aboveground plant enemies? Lead PI: Scott A. Mangan. **Co-PIs: R. M. Penczykowski and Claudia Stein.** 2017-2018

FELLOWSHIPS

- National Science Foundation Graduate Research Fellowship (\$92,000 + tuition) 2010 – 2013
- Georgia Tech President's Fellowship (\$22,000) 2008 – 2012

HONORS AND AWARDS

- Best Student Talk Award, Georgia Tech School of Biology retreat 2012
- P.E.O. Scholar Award (\$15,000) 2012

PEER-REVIEWED PUBLICATIONS (underlining indicates undergraduates whom I mentored)

18. **Penczykowski, R. M.**, S. R. Parratt, B. Barrès, S. K. Sallinen, and A-L Laine. Manipulating host resistance structure reveals impact of pathogen dispersal and environmental heterogeneity on epidemics. *Ecology*, accepted.
17. Hite, J. L., **R. M. Penczykowski**, M. S. Shocket, K. Griebel, A. T. Strauss, M. A. Duffy, C. E. Cáceres, and S. R. Hall. 2017. Allocation, not male resistance, increases male frequency during epidemics: a case study in facultatively sexual hosts. *Ecology*, 98: 2773-2783.
16. **Penczykowski, R. M.**, B. M. Connolly, and B. T. Barton. 2017. Winter is changing: trophic interactions under altered snow regimes. *Food Webs*, 13: 80-91.
15. Parratt, S. R., B. Barrés, **R. M. Penczykowski**, and A-L Laine. 2017. Local adaptation at higher trophic levels: Contrasting hyperparasite-pathogen infection dynamics in the field and laboratory. *Molecular Ecology*, 26: 1964-1979.
14. Strauss, A. T., M. S. Shocket, D. J. Civitello, J. L. Hite, **R. M. Penczykowski**, M. A. Duffy, C. E. Cáceres, and S. R. Hall. 2016. Habitat, predators, and hosts regulate disease in *Daphnia* through direct and indirect pathways. *Ecological Monographs*, 86: 393-411.
13. Hite, J. L., **R. M. Penczykowski**, M. S. Shocket, A. T. Strauss, P. A. Orlando, M. A. Duffy, C. E. Cáceres, and S. R. Hall. 2016. Parasites destabilize host populations by shifting stage-structured interactions. *Ecology*, 97:439-449.
12. **Penczykowski, R. M.**, A-L Laine, and B. Koskella. 2016. Understanding the ecology and evolution of host-parasite interactions across scales. *Evolutionary Applications*, 9:37-52.
11. Civitello, D. J., **R. M. Penczykowski**, A. Smith, M. S. Shocket, M. A. Duffy, and S. R. Hall. 2015. Resources, key traits, and the size of fungal epidemics in *Daphnia* populations. *Journal of Animal Ecology*, 84:1010-1017.
10. **Penczykowski, R. M.**, E. Walker, S. Soubeyrand, and A-L Laine. 2015. Linking winter conditions to regional disease dynamics in a wild plant-pathogen metapopulation. *New Phytologist*, 205:1142-1152.
9. **Penczykowski, R. M.**, B. C. P. Lemanski, R. D. Sieg, S. R. Hall, J. Housley Ochs, J. Kubanek, and M. A. Duffy. 2014. Poor resource quality lowers transmission potential by changing foraging behaviour. *Functional Ecology*, 28:1245-1255.
8. **Penczykowski, R. M.**, S. R. Hall, D. J. Civitello, and M. A. Duffy. 2014. Habitat structure and ecological drivers of disease. *Limnology & Oceanography*, 59:340-348.

7. Auld, S. K. J. R., **R. M. Penczykowski**, J. Housley Ochs, D. C. Grippi, S. R. Hall, and M. A. Duffy. 2013. Variation in costs of parasite resistance among natural host populations. *Journal of Evolutionary Biology*, 26:2479-2486.
6. Civitello, D. J., **R. M. Penczykowski**, J. L. Hite, M. A. Duffy, and S. R. Hall. 2013. Potassium stimulates fungal epidemics in *Daphnia* by increasing host and parasite reproduction. *Ecology*, 94:380-388.
5. Duffy, M. A., J. Housley Ochs, **R. M. Penczykowski**, D. J. Civitello, C. A. Klausmeier, and S. R. Hall. 2012. Ecological context influences epidemic size and parasite-driven evolution. *Science*, 335:1636–1638.
4. Duffy, M. A., J. M. Housley, **R. M. Penczykowski**, C. E. Cáceres, and S. R. Hall. 2011. Unhealthy herds: indirect effects of predators enhance two drivers of disease spread. *Functional Ecology*, 25:945–953.
3. Thomas, S. H., J. M. Housley, A. N. Reynolds, **R. M. Penczykowski**, K. H. Kenline, N. Hardege, S. Schmidt, and M. A. Duffy. 2011. The ecology and phylogeny of oomycete infections in *Asplanchna* rotifers. *Freshwater Biology*, 56:384-394.
2. **Penczykowski, R. M.**, S. E. Forde, and M. A. Duffy. 2011. Rapid evolution as a possible constraint on emerging infectious diseases. *Freshwater Biology*, 56:689-704.
1. Kamarainen, A. M., **R. M. Penczykowski**, M. C. Van de Bogert, P. C. Hanson, and S. R. Carpenter. 2009. Phosphorus sources and demand during summer in a eutrophic lake. *Aquatic Sciences*, 71:214-227.

INVITED PRESENTATIONS

- Nov. 2018: Seminar, Donald Danforth Plant Science Center, St. Louis, MO
- Nov. 2018: Biology Colloquium, Southern Illinois University, Edwardsville, IL
- 2018: Seminar, University of Nebraska, School of Biological Sciences, Lincoln, NE
- 2018: Bioforum presentation, Washington University, Department of Biology, St. Louis, MO
- 2017: St. Louis Ecology, Evolution, and Conservation (SLEEC) Annual Retreat, St. Louis, MO
- 2017: Biology Colloquium, UW-Madison, Departments of Zoology and Botany, Madison, WI
- 2016: Seminar, Washington University, Department of Biology, St. Louis, MO
- 2015: Seminar, University of Alabama, Department of Biological Sciences, Tuscaloosa, AL
- 2015: Seminar, Dartmouth University, Biological Sciences Department, Hanover, NH
- 2015: Seminar, Purdue University, Department of Botany and Plant Pathology, West Lafayette, IN
- 2014: Seminar, University of Wisconsin-Madison, Department of Plant Pathology, Madison, WI
- 2014: Experimental Evolution and Community Dynamics Symposium, Helsinki, Finland
- 2014: Seminar, Department of Ecology and Evolutionary Biology, University of Helsinki, Finland

CONTRIBUTED PRESENTATIONS

- 2018: Ecological Society of America, New Orleans, LA
- 2016: Wild Plant Pathosystems, Helsinki, Finland (poster)
- 2016: Ecological Society of America, Ft. Lauderdale, FL
- 2015: Ecological Society of America, Baltimore, MD
- 2014: Spatial Evolutionary Epidemiology, Montpellier, France (poster)
- 2014: Nordic Oikos, Stockholm, Sweden
- 2013: Ecological Society of America, Minneapolis, MN
- 2013: Ecology and Evolution of Infectious Disease, State College, PA (poster)
- 2012: Georgia Tech, School of Biology Retreat, Helen, GA
- 2012: Ecological Society of America, Portland, OR
- 2011: Ecological Society of America, Austin, TX
- 2010: American Society of Limnology and Oceanography, Santa Fe, NM (poster)

2009: Ecological Society of America, Albuquerque, NM

2008: University of Wisconsin-Madison, Center for Limnology, Madison, WI

TEACHING EXPERIENCE

Washington University in St. Louis

Instructor, BIOL 4195 – Disease Ecology (new course developed by Penczykowski), SP 2019

Instructor, BIOL 580 – Seminar in Population Biology, FL 2018

Guest lecture, BIOL 181 – First-Year Opportunity: Introduction to Cutting-Edge Research in Biology, 30 October 2018

Guest lecture and lab activity, BIOL 524 – Ecology and Environmental Science for K-12 Science Teachers, Tyson Research Center, 19 July 2018

University of Helsinki

Course Co-Coordinator, Population Biology in Fragmented Landscapes, FL 2014

UNDERGRADUATE MENTORING EXPERIENCE

Washington University in St. Louis (*Tyson Research Center Undergraduate Research Fellow)

Imani Jones, Wash. U. FL 2018

*Austin Chen, Wash. U. FL 2017 – Present

Rachel Fan, Wash. U., BIOL 500 and Senior Thesis FL 2017 – Present

*Arjun Puri, Wash. U. SM 2018 – Present

*Sheena Stevens, Univ. Missouri St. Louis SM 2018

*Sabrina Talir, Mount Holyoke College SM 2018

University of Wisconsin-Madison

Manika Luhano, UW-Madison, BIO 152 Independent Research FL 2016 – SP 2017

University of Helsinki

Suvi Sallinen, Ecological Training Program & M.Sc. Thesis Research SM 2014 – FL 2016

Georgia Tech

Brian C. P. Lemanski, Colgate University, NSF REU Program SM 2012

Alison E. Burger, Georgia Tech SP 2011

Hema Sundar, Georgia Tech SP 2011 – SP 2012

Abigail N. Reynolds, Georgia Tech SP 2009 – FL 2010

Grace M. Wilkinson, St. Olaf College, NSF REU Program SM 2009

PHD ROTATION STUDENTS SUPERVISED

Washington University in St. Louis: Evolution, Ecology & Population Biology (EEPB) Program

Rhiannon Vargas, Washington University in St. Louis, EEPB SM – FL 2018

David Henderson, Washington University in St. Louis, EEPB FL 2018

PHD THESIS ADVISORY COMMITTEES

James Lucas, Washington University in St. Louis, EEPB FL 2018 – Present

Rachel Becknell, Washington University in St. Louis, EEPB FL 2017 – Present

Christopher Catano, Washington University in St. Louis, EEPB SP 2018 – Present

Dilys Vela, Washington University in St. Louis, EEPB SP 2018 – Present

Holly Bernardo, Washington University in St. Louis, EEPB SP 2018 – SM 2018

SERVICE AT WASHINGTON UNIVERSITY

Department of Biology

Host for departmental seminar speakers (E. T. Borer) SP 2019
Judge for Marian Smith Spector Prize for Undergraduate Senior Honors Thesis SP 2018
Mentor for undergraduate researchers in BIOL 500 FL 2017 – Present

Evolution, Ecology & Population Biology Program

EEPB Qualifying Exam Committee 2018 – 2019
EEPB Graduate Student Symposium, Co-organizer FL 2018
EEPB Graduate Program Improvement Sub-committee SP 2018 – Present
EEPB Statistical Resources Liaison SP 2018 – Present
EEPB Admissions Committee FL 2017 – Present
EEPB Steering Committee FL 2017 – Present

Tyson Research Center

Host for summer seminar series speaker (E. C. Rynkiewicz) SM 2018
Mentor for summer undergraduate research fellows SM 2018

SERVICE AT GEORGIA TECH

Judge for Georgia Tech Undergraduate Research Spring Symposium 2013
School of Biology Scientific Retreat Planning Committee 2010
Co-President, Biology Graduate Student Association 2010

PROFESSIONAL SERVICE

Reviewer for: *American Naturalist*, *BMC Ecology*, *Ecology and Evolution*, *Ecology Letters*,
Evolution, *Evolutionary Applications*, *Food Webs*, *Freshwater Biology*, *Hydrobiologia*,
Journal of Animal Ecology, *Limnology and Oceanography*, *Nature Ecology and Evolution*,
New Phytologist, *Oikos*, and *PLOS ONE*
External grant reviewer for National Science Foundation

OUTREACH ACTIVITIES

Washington University in St. Louis

Panelist, Tyson Research Ctr. career panel for undergraduate & high school students (SM 2018)

University of Wisconsin-Madison

Guest Scientist, Junior Science Café, led science career discussions and activities with 5-7th
graders (3 x 1.5-hr sessions, SP 2017)
Workshop Leader, ‘College for Kids’ limnology workshop for 6th graders (3 wks, SM 2008)

University of Helsinki

Activity Leader, ‘Tiede Tulee Tarhaan’ (‘Science Goes Kindergarten’) biology workshop for
kindergarteners (2-3 days each in FL 2013, 2014, and 2015)

Georgia Tech

Activity Leader, ‘Plankton Day’ at Piedmont Park Summer Camp. Led urban aquatic ecology
activities for children ages 5-11 (SM 2009, 2010, 2011)
Guest Scientist, 5th grade class, Warren T. Jackson Elementary School. Led plankton
identification activities and discussions about freshwater ecosystems (FL 2008)

Guest Scientist, I.B. biology class, Marietta High School. Gave short lectures and guided students in designing urban aquatic ecology group projects (SP 2011 and SP 2013)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Ecological Society of America

American Phytopathological Society

500 Women Scientists