

## **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.

### **ACADEMIC APPOINTMENTS**

**Assistant Professor** Sept 2017 – Present  
Department of Biology  
Division of Biology & Biomedical Sciences (DBBS) program affiliations: Evolution, Ecology & Population Biology (EEPB), Plant & Microbial Biosciences (PMB)  
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

- Tyson Faculty Seed Grant for Interdisciplinary Research (\$20,000), Title: Effects of a fungal foliar pathogen on nutrient dynamics in a model food web. **Lead PI: R. M. Penczykowski**. Co-PIs: David A. Fike and Amanda M. Koltz. 2019.
- 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. 2018. Manipulating host resistance structure reveals impact of pathogen dispersal and environmental heterogeneity on epidemics. *Ecology*, 99: 2853-2863.
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. Hardegee, 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

- Sept. 2019: Invited Talk, Wild Plant Pathosystems, Frankfurt, Germany  
(PENDING) Aug. 2019: Symposium Talk, European Soc. of Evolutionary Biology, Turku, Finland  
Aug. 2019: Symposium Talk, Ecological Society of America, Louisville, KY  
Feb. 2019: Seminar, St. Louis University, Department of Biology, St. Louis, MO  
2018: Seminar, Donald Danforth Plant Science Center, St. Louis, MO  
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

**WORKSHOP AND WORKING GROUP PARTICIPATION**

2018: Wash. U. LEC working group on parasites & ecosystem nutrient cycling, St. Louis, MO  
 2018: British Ecological Society Spatial Statistics workshop, Glasgow, Scotland  
 2014: Spatial Evolutionary Epidemiology workshop, Montpellier, France  
 2011: Ecology and Evolution of Infectious Diseases modeling workshop, Santa Barbara, CA  
 2010: Enhancing Linkages between Math & Ecology workshop, Kellogg Biological Station, MI

**TEACHING EXPERIENCE**

**Washington University in St. Louis**

Course	Description	Role	Students	Semester
BIOL 4195	Disease Ecology (4 credits)	Course master; new course developed by Penczykowski	24 undergraduate & 4 graduate students	SP 2019
BIOL 580	Seminar in Ecology & Evolution (1 credit)	Course master	7 graduate students	FL 2018
BIOL 181	First-Year Opportunity: Introduction to Cutting-Edge Research in Biology	Guest lecture	48 freshman undergraduate students	Oct 2018
BIOL 524	Ecology & Environmental Science for K-12 Science Teachers	Guest lecture & lab activity at Tyson Research Center	28 K-12 science teachers	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)**

Elly Grant, Wash. U. SP 2019  
 Jack Steffy, Wash. U. SP 2019  
 Emma Waltman, Wash. U., BIOL 500 SP 2019  
 Imani Jones, Wash. U. FL 2018 – Present  
 \*Austin Chen, Wash. U. FL 2017 – Present  
 Rachel Fan, Wash. U., BIOL 500 and Senior Thesis FL 2017 – SP 2019  
 \*Arjun Puri, Wash. U. SM 2018  
 \*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**

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

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

## **PHD THESIS ADVISORY COMMITTEES**

Winston Anthony, Washington University in St. Louis, Molecular Cell Biology FL 2018 – Present

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

## **ADDITIONAL INTERDISCIPLINARY ACTIVITIES AT WASHINGTON UNIVERSITY**

Environmental Studies affiliated faculty member

Living Earth Collaborative Biodiversity Fellow

Project mentor for MEMS 411 Mechanical Engineering Design Project, FL 2018

## **SERVICE AT WASHINGTON UNIVERSITY**

### **Department of Biology**

Environmental Biology Major Advisor FL 2018 – Present

Biology Major Advisor FL 2018 – Present

Judge for Marian Smith Spector Prize for Undergraduate Senior Honors Thesis SP 2018

Mentor for undergraduate researchers in BIOL 500 FL 2017 – Present

Environmental Biology Major Steering Committee FL 2017 – Present

### **Evolution, Ecology & Population Biology Program (Div. of Biology & Biomedical Sciences)**

EEPB Qualifying Exam Committee 2018 – 2019

EEPB Graduate Student Symposium, Co-organizer FL 2018

EEPB Graduate Program Improvement Sub-committee SP 2018 – Present

EEPB Admissions Committee FL 2017 – Present

EEPB Steering Committee FL 2017 – Present

### **Plant & Microbial Biosciences Program (Div. of Biology & Biomedical Sciences)**

PMB Breakfast Faculty Presentation FL 2018

### **Tyson Research Center (College of Arts & Sciences)**

Mentor for student presentation at Wash. U. Undergraduate Research Symposium FL 2018  
Mentor for summer undergraduate research fellows SM 2018 – Present  
Participant in undergraduate recruitment events (annual; fall semester) FL 2017 – Present

### **Living Earth Collaborative**

Postdoctoral Selection Committee FL 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<sup>th</sup>  
graders (3 x 1.5-hr sessions, SP 2017)

Workshop Leader, ‘College for Kids’ limnology workshop for 6<sup>th</sup> 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, 5<sup>th</sup> 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