

RACHEL M. PENCZYKOWSKI

Assistant Professor, Department of Biology, Washington University in St. Louis,
Campus Box 1137, One Brookings Drive, St. Louis, MO 63130
(314) 935-8282 | rpencykowski@wustl.edu | <https://pencykowskiilab.com>

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 | arives@wisc.edu

Postdoctoral Researcher Oct 2013 – April 2016
Metapopulation Research Centre
University of Helsinki, Finland
Advisor: Anna-Liisa Laine | anna-liisa.laine@ieu.uzh.ch

EDUCATION

Ph.D. in Biology 2008 – 2013
Georgia Institute of Technology (Georgia Tech), Atlanta, GA, USA
Advisor: Meghan A. Duffy | duffymeg@umich.edu
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 | steve.carpenter@wisc.edu

GRANTS

- Tyson Faculty Seed Grant for Interdisciplinary Research (\$20,000), Title: Electromechanical Design for Ecological Research. Lead PI: J. Jackson Potter. **Co-PI: Rachel M. Penczykowski**. 2020.
- 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. 2018-2020
- 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)

19. Ives, A. R., B. T. Barton, **R. M. Penczykowski**, J. P. Harmon, K. L. Kim, K. Oliver, and V. C. Radeloff. Self-perpetuating ecological-evolutionary dynamics in an agricultural host-parasite system. Accepted at *Nature Ecology & Evolution*.
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. Hardegree, 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 SEMINARS

- 2020: Seminar, University of Missouri St. Louis, MO
2019: Seminar, Purdue University, Department of Biological Sciences, West Lafayette, IN
2019: Seminar, University of Pittsburgh, Pittsburgh, PA
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
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: Seminar, Department of Ecology and Evolutionary Biology, University of Helsinki, Finland

INVITED TALKS

- 2020: American Society of Naturalists Vice Presidential Symposium, Cleveland, OH
2019: Wild Plant Pathosystems, Frankfurt, Germany
2019: Symposium, Ecological Society of America, Louisville, KY

2018: Bioforum presentation, Washington University, Department of Biology, St. Louis, MO
 2017: St. Louis Ecology, Evolution, and Conservation (SLEEC) Annual Retreat, St. Louis, MO
 2014: Experimental Evolution and Community Dynamics Symposium, Helsinki, Finland

CONTRIBUTED PRESENTATIONS

2019: St. Louis Plant-Microbe and Microbiome Meetup Event, St. Louis, MO
 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 & 2019: Wash. U. LEC working group, 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 AT WASHINGTON UNIVERSITY

Course	Description	Role	Students	Semester
BIOL 4195	Disease Ecology (4 credits)	Course master	23 undergrad & 7 grad	SP 2020
BIOL 580	Seminar in Ecology & Evolution (1 credit)	Course master	11 grad	FL 2019
BIOL 4195	Disease Ecology (4 credits)	Course master; developed new course	18 undergrad & 3 grad	SP 2019
BIOL 580	Seminar in Ecology & Evolution (1 credit)	Course master	7 grad	FL 2018
BIOL 181	First-Year Opportunity: Introduction to Cutting-Edge Research in Biology	Guest lecture	48 undergrad (49 in 2019)	Oct 2018, Oct 2019
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

TEACHING EXPERIENCE AT UNIVERSITY OF HELSINKI

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

HIGH SCHOOL STUDENTS MENTORED

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

Bernadette Bergman	SM 2019*
Vlada Gladun	SM 2019*
Kate Pogue	SM 2019*

UNDERGRADUATES MENTORED

Washington University in St. Louis (*Tyson Undergraduate Fellow; †BIOL 200/500 research)

Michelle Pollowitz, Wash. U.	SP 2020†
Selaam Dollisso, Wash. U.	FL 2019, SP 2020
Taewon Lee, Wash. U.	SM 2019*, FL 2019, SP 2020
Armando Sanchez-Conde, Wash. U.	SM 2019†, FL 2019†, SP 2020†
Laura Goh, Wash. U.	SM 2019*
Elly Grant, Wash. U.	SP 2019, SM 2019*, FL 2019†, SP 2020†
Emma Waltman, Wash. U.	SP 2019†, SM 2019*, FL 2019, SP 2020
Akosua Sarfo, Wash. U.	SP 2019†, FL 2019, SP 2020
Jack Steffy, Wash. U.	SP 2019
Imani Jones, Wash. U.	FL 2018, SP 2019, FL 2019, SP 2020
Sabrina Talir, Mount Holyoke College	SM 2018*, SM 2019, Dec 2019 - Jan 2020
Arjun Puri, Wash. U.	SM 2018*
Sheena Stevens, Univ. Missouri St. Louis	SM 2018*
Rachel Fan, Wash. U.	FL 2017†, SP 2018†, FL 2018†, SP 2019†
Austin Chen, Wash. U.	FL 2017, SP 2018, SM 2018*, FL 2018, SP 2019, FL 2019, SP 2020

University of Wisconsin-Madison

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

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

Co-advisor of Rachel Becknell, Washington University in St. Louis, EEPB	SP 2019 – Present
Philippa Tanford	FL 2019 – Present

PHD ROTATION STUDENTS MENTORED

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

Mahal Bugay, Washington University in St. Louis, EEPB	FL 2019
Quinn Fox, Washington University in St. Louis, EEPB	SM – FL 2019
Philippa Tanford, Washington University in St. Louis, EEPB	SP – SM 2019
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 – SP 2019
Dilys Vela, Washington University in St. Louis, EEPB	SP 2018 – SP 2019
Holly Bernardo, Washington University in St. Louis, EEPB	SP 2018 – SM 2018

QUALIFYING EXAM COMMITTEES (EEPB)

David Henderson, SP 2020
Rhiannon Vargas, SP 2020
Shreenidhi Perukkaranaï Madabhushi, SP 2019
James Medina, FL 2018
James Lucas, FL 2018

ADDITIONAL INTERDISCIPLINARY ACTIVITIES AT WASHINGTON UNIVERSITY

Environmental Studies affiliated faculty member
Living Earth Collaborative Biodiversity Fellow
Co-organizer of Urban Ecology and Evolution working group (LEC funded)
Participant/Co-organizer of St. Louis Plant-Microbe & Microbiome (PMM) Meet-up group, SP 2019
Project mentor for MEMS 411 Mechanical Engineering Design Project, FL 2018

SERVICE AT WASHINGTON UNIVERSITY

Department of Biology

Biology Inclusion Committee	SP 2019 – Present
Environmental Biology Major Advisor	FL 2018 – Present
Biology Major Advisor	FL 2018 – Present
Judge for BioSURF applications	SP 2019
Judge for Marian Smith Spector Prize for Undergraduate Senior Honors Thesis	SP 2018
Spector/Quatrano Award Committee	2019 – 2020
Mentor for undergraduate researchers	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 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
Interviewer for PMB PhD applicants	SP 2019, SP 2020

Tyson Research Center (College of Arts & Sciences)

Mentor for student presentations at Wash. U. Undergraduate Research Symposium	FL 2018, 2019
Mentor for summer undergraduate research fellows	SM 2018 – Present
Participant in undergraduate recruitment events (annual; fall semester)	FL 2017 – Present

Living Earth Collaborative

Living Art Collaborative Design Committee
Postdoctoral Selection Committee

SP 2019
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*, *Ecology and Evolution*, *Ecology Letters*,
Evolution, *Evolutionary Applications*, *Food Webs*, *Freshwater Biology*, *Hydrobiologia*,
Journal of Animal Ecology, *Limnology and Oceanography*, *Molecular Ecology*, *Nature*
Ecology and Evolution, *New Phytologist*, *Oecologia*, *Oikos*, *PLOS ONE*, *Proceedings B*,
Trends in Ecology & Evolution

External grant reviewer for National Science Foundation and European Research Council
Panelist for NSF DEB program

OUTREACH ACTIVITIES

Washington University in St. Louis

Market Fresh Science at Ferguson Farmers Market (FL 2019)
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