

## **RACHEL M. PENCZYKOWSKI**

Assistant Professor, Department of Biology, Washington University in St. Louis,  
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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 (WashU), 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](mailto: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](mailto: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](mailto: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](mailto: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: Rachel 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: Rachel 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: Rachel M. Penczykowski** and Claudia Stein. 2017-2018

## FELLOWSHIPS

- |  |             |
|--|-------------|
| National Science Foundation Graduate Research Fellowship | 2010 – 2013 |
| Georgia Tech President's Fellowship                      | 2008 – 2012 |

## HONORS AND AWARDS

- |   |      |
|---|------|
| Best Student Talk Award, Georgia Tech School of Biology retreat | 2012 |
| P.E.O. Scholar Award  | 2012 |

## PEER-REVIEWED PUBLICATIONS

\* = Penczykowski is corresponding author, underlined = undergraduate mentored by Penczykowski,

21. Ezenwa, V. O., D. J. Civitello, B. T. Barton, D. J. Becker, M. Brenn-White, A. T. Classen, S. L. Deem, Z. E. Johnson, S. Kutz, M. Malishev, **R. M. Penczykowski**, D. L. Preston, J. T. Vannatta, A. M. Koltz. 2020. Infectious diseases, livestock, and climate: a vicious cycle? In press at *Trends in Ecology & Evolution*.
20. Halliday\*, F. W., **R. M. Penczykowski\***, B. Barrès, J. L. Eck, E. Numminen, and A.-L. Laine. 2020. Facilitative priority effects drive pathogen community assembly in a wild-plant pathosystem. In press at *Nature Ecology & Evolution*. (**\*co-first / co-corresponding authors**)
19. Ives, A. R., B. T. Barton, **R. M. Penczykowski**, J. P. Harmon, K. L. Kim, K. Oliver, and V. C. Radeloff. 2020. Self-perpetuating ecological-evolutionary dynamics in an agricultural host-parasite system. *Nature Ecology & Evolution*, 4: 702–711.
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.

#### MANUSCRIPTS IN REVISION OR REVIEW

**Penczykowski\***, **R. M.**, S. R. Hall, M. S. Shocket, J. Housley Ochs, **B. C. P. Lemanski**, **H. Sundar**, and M. A. Duffy. Virulent disease epidemics can increase host density by depressing foraging of hosts. Minor revisions, *American Naturalist*.

**Penczykowski\***, **R. M.** and R. D. Sieg. *Plantago* spp. as models for studying the ecology and evolution of species interactions across environmental gradients. In review, *American Naturalist*.

### **INVITED SEMINARS AND COLLOQUIA**

2020: Department of Biology, Washington University, St. Louis, MO  
2020: UC Berkeley Ecology and Evolution of Infectious Disease Seminar, via Zoom  
2019: Department of Biological Sciences, Purdue University, West Lafayette, IN  
2019: University of Pittsburgh, Pittsburgh, PA  
2019: Department of Biology, St. Louis University, St. Louis, MO  
2018: Donald Danforth Plant Science Center, St. Louis, MO  
2018: Southern Illinois University - Edwardsville, IL  
2018: School of Biological Sciences, University of Nebraska, Lincoln, NE  
2017: Departments of Zoology and Botany, UW-Madison, Madison, WI  
2016: Department of Biology, Washington University, St. Louis, MO  
2015: Department of Biological Sciences, University of Alabama, Tuscaloosa, AL  
2015: Biological Sciences Department, Dartmouth University, Hanover, NH  
2015: Department of Botany and Plant Pathology, Purdue University, West Lafayette, IN  
2014: Department of Plant Pathology, University of Wisconsin-Madison, Madison, WI  
2014: Department of Ecology and Evolutionary Biology, University of Helsinki, Finland

### **INVITED TALKS**

Upcoming Jan 2021: American Society of Naturalists Vice Presidential Symposium, via Zoom  
2019: Wild Plant Pathosystems, Frankfurt, Germany  
2019: Symposium, Ecological Society of America, Louisville, KY  
2014: Experimental Evolution and Community Dynamics Symposium, Helsinki, Finland

### **TALKS AT MEETINGS**

2019: St. Louis Plant-Microbe and Microbiome Meetup Event, St. Louis, MO  
2018: Ecological Society of America, New Orleans, LA  
2018: Bioforum presentation, Washington University, Department of Biology, St. Louis, MO  
2017: St. Louis Ecology, Evolution, and Conservation (SLEEC) Annual Retreat, St. Louis, MO  
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

### **PUBLIC TALKS**

2020: WashU Women in STEM, The Leading Women Research Symposium, St. Louis, MO

### **WORKSHOP AND WORKING GROUP PARTICIPATION**

2018 & 2019: WashU 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

**CONTRIBUTIONS OF DATA TO SCIENTIFIC NETWORKS**

2020: Contributed soil and air temperature data to SoilTemp: a global database of soil and near-surface temperatures, <https://soiltemp.weebly.com/>  
 2019 & 2020: Contributed annual census data to PlantPopNet: a spatially distributed model system for population ecology, <https://www.plantpopnet.com/>

**SEMESTER-LONG COURSES TAUGHT AT WASHINGTON UNIVERSITY**

Course	Description	Credits	Role	Students	Semester
BIOL 580	Seminar in Ecology & Evolution	1	Course master	12 grad	FL 2020
BIOL 4195	Disease Ecology	4	Course master	23 undergrad + 7 grad	SP 2020
BIOL 580	Seminar in Ecology & Evolution	1	Course master	11 grad	FL 2019
BIOL 4195	Disease Ecology	4	Course master; developed new course	18 undergrad + 3 grad	SP 2019
BIOL 580	Seminar in Ecology & Evolution	1	Course master	7 grad	FL 2018

**GUEST LECTURES TAUGHT WHILE AT WASHINGTON UNIVERSITY**

Course	Description	Role	Students	Date
Fontbonne BIO 325	Disease Ecology at Fontbonne University	Guest lecturer	14 undergrad	Oct 2020
COVID Course	The Pandemic: Science and Society	Guest lecturer	>1300	Aug 2020
BIOL 3220	Woody Plants of Missouri	Guest lecturer	10	April 2020
BIOL 181	First-Year Opportunity: Introduction to Cutting-Edge Research in Biology	Guest lecturer	49 undergrad	Oct 2019
BIOL 181	First-Year Opportunity: Introduction to Cutting-Edge Research in Biology	Guest lecturer	48 undergrad	Oct 2018
BIOL 524	Ecology & Environmental Science for K-12 Science Teachers at Tyson Research Center	Guest lecturer & leader of lab activity	28 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

Vlada Gladun

Kate Pogue

SM 2019\*

SM 2019\*

SM 2019\*

## **UNDERGRADUATES MENTORED**

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

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

## **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 STUDENTS MENTORED**

Mahal Bugay, WashU, EEPB FL 2020 – Present  
Quinn Fox, WashU, EEPB FL 2020 – Present  
Rachel Becknell, WashU, EEPB SP 2019 – Present  
Philippa Tanford, WashU, EEPB FL 2019 – Present

## **PHD ROTATION STUDENTS MENTORED**

Ryan Valdez, WashU, PMB SP 2020  
Mahal Bugay, WashU, EEPB FL 2019  
Quinn Fox, WashU, EEPB SM – FL 2019  
Philippa Tanford, WashU, EEPB SP – SM 2019  
David Henderson, WashU, EEPB FL 2018  
Rhiannon Vargas, WashU, EEPB FL 2018

## **PHD THESIS ADVISORY COMMITTEES**

Elizabeth Green, University of North Carolina at Chapel Hill FL 2020 – Present  
Rhiannon Vargas, WashU, EEPB FL 2020 – Present  
David Henderson, WashU, EEPB FL 2020 – Present

Winston Anthony, WashU, Molecular Cell Biology	FL 2018 – Present
James Lucas, WashU, EEPB	FL 2018 – Present
Rachel Becknell, WashU, EEPB	FL 2017 – Present
Christopher Catano, WashU, EEPB	SP 2018 – SP 2019
Dilys Vela, WashU, EEPB	SP 2018 – SP 2019
Holly Bernardo, WashU, EEPB	SP 2018 – SM 2018

**QUALIFYING EXAM COMMITTEES (WASHINGTON UNIVERSITY EEPB)**

David Henderson	SP 2020
Rhiannon Vargas	SP 2020
P. M. Shreenidhi	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), SP 2020 – Present  
 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
Organizer/Moderator, "COVID-19 & the WashU Community" panel discussion	3/2020
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
Environmental Biology Curriculum Committee	FL 2020 – Present

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

EEPB Spring Symposium Planning Committee	2020 - 2021
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 WashU 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  
School of Biology Scientific Retreat Planning Committee  
Co-President, Biology Graduate Student Association

2013  
2010  
2010

## **PROFESSIONAL SERVICE**

Reviewer for: *American Naturalist*, *BMC Ecology*, *Conservation Biology*, *Ecology*, *Ecology and Evolution*, *Ecology Letters*, *Environmental Microbiology*, *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*, *PNAS*, *Proceedings B*, *Trends in Ecology & Evolution*

External grant reviewer for National Science Foundation and European Research Council  
Panelist for NSF DEB program (in-person panel FL 2019)

## **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 5-7<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