

Jacob S. Francis

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Professional Appointments and Education

January 2024: Assistant Professor, Department of Biology Florida Atlantic University.

Current: National Science Foundation Postdoctoral Research Fellow. The University of California Davis. Advisors: Rachel Vannette and Daniel Kliebenstein.

2020-2022: Postdoctoral Scholar. The University of California Davis. Advisor: Rachel Vannette.

2020: Ph.D. The University of Nevada Reno. Advisor: Anne Leonard. Department of Biology, Program in Ecology, Evolution, and Conservation Biology.

2011: B.S. The University of North Carolina at Asheville. Advisors: Jonathan Horton, David Clarke, and Jennifer Ward. Biology, Concentration: Ecology and Evolution, *Summa Cum Laude*, Distinction as a Research Scholar and Honors Scholar.

Publications

*Indicates an undergraduate or post-baccalaureate co-author

†Indicates an equal contribution

1. **Francis JS**, Muller TG, Vannette RL, 2023, Intraspecific variation in realized dispersal probability and host quality shape nectar microbiomes. Accepted at *New Phytologist*.
2. Muller TG*, **Francis JS**, Vannette RL. 2023. Nectar compounds impact bacterial and fungal growth and shift community dynamics in a nectar analog. *Environmental Microbiology Reports*. 15(3): 170-180.
3. †**Francis JS**, †Tatarko AR, Richman SK, Vaudo AD, Leonard AS. 2021. Microbes and pollinator behavior in the floral marketplace. *Current Opinions in Insect Science*. 44: 16-22.
4. Oyang JQ, Macaballug P*, Chen H*, Hodach K*, Tang S*, **Francis JS**. 2021. Infrared thermography is an effective, non-invasive measure of HPA activation and inhibition. *Stress*. 1-6.
5. Vaudo AD, Tooker JF, Patch HM, Biddinger DJ, Coccia M, Crone MK, Fiely M, **Francis JS**, Hines HM, Hodges M, Jackson SW, Michez D, Mu J, Russo L, Safari M, Treanore ED, Vanderplanck M, Yip E, Leonard AS, Grozinger CM. 2020. Pollen protein: lipid ratios may guide broad patterns of bee species floral preferences. *Insects*. 11(2): 132.
6. **Francis JS**, Acevedo CR*, Muth F, Leonard AS. 2019. Nectar quality changes the ecological cost of defended pollen. *Current Biology*. 29(14). PR679-R680.
7. Muth F, **Francis JS**, Leonard AS. 2019. Modality-specific impairment of learning by a neonicotinoid pesticide. *Biology Letters*. 15(7): 20190359.

8. Harrison JG, Philbin CS, Gompert Z, Forister GW, Hernandez-Espinoza L, Sullivan BW, Wallace IS, Beltran L, Dodson CD, **Francis JS**, Schlageter A, Shelef O, Yoon SA, Forister MA. 2018. Deconstruction of a plant-arthropod community reveals influential plant traits with nonlinear effects on arthropod assemblages. *Functional Ecology*. 32(5). 1317-1328.
9. Leonard AS, **Francis JS**. 2017. Plant-animal communication: past, present, and future. *Evolutionary Ecology*. 31(2): 143-151.
10. Muth F, **Francis JS**, Leonard AS. 2016. Bees use taste to determine which flowers to visit. *Biology Letters*. 12(7): 20160356
11. **Francis JS**, Muth F, Papaj DR, Leonard AS. 2016. Nutritional complexity and the structure of bee foraging bouts. *Behavioral Ecology*. 27(3). 903-911.
12. Horton J, **Francis JS**. 2014. Using Dendroecology to Examine the Effect of *Celastrus orbiculatus* invasion on *Liriodendron tulipifera* Growth. *American Midland Naturalist*. 172(1): 25-36.

In Prep (MS avail upon request):

Francis JS, Leonard AS. Pollen quality and holistic nutritional similarity drive patterns of pollen transfer among co-flowering plant species.

Grants, Academic Awards, and Honors

Research: \$35150 | Travel: \$4216 | Scholarship: \$263,750

National Science Foundation Postdoctoral Research Fellowship (\$100,000 / \$30,000)

National Science Foundation Graduate Research Fellowship (\$134,000)

Steve and Kathy Jenkins Fellowship (departmental, 1 graduate student per year \$21,850)

Jerry and Betty Wilson Scholarship (\$2000)

University of Nevada COS Dean's Scholar- (1 incoming graduate student per year \$5000)

Northern California Botanist Research Scholarship (\$1000)

Animal Behavior Society Student Travel Grant (\$800)

UNR Graduate Student Poster Competition 3rd place (\$100)

UNR Ecology, Evolution, and Conservation Biology research grant (\$450)

Best Graduate Talk, Entomological Society of America Pacific Branch Meeting (\$200)

UNR graduate paper competition 2nd place (\$200)

UNR Graduate travel grants (4-\$2200)

Harry H. Johnston Award for Excellence in Biology UNCA

University of North Carolina at Asheville Honors Scholar

University of North Carolina at Asheville Research Scholar

University of North Carolina at Asheville Undergraduate Research Travel Grant (2-\$1216)

University of North Carolina at Asheville Undergraduate Research Grant (\$2500)

John and Elizabeth IZARD Scholarship to Support Botanical Research in WNC (\$1200)

Mentoring and Teaching Experience

- 2016: *Instructor of Record*, University of Nevada: Field Ecology. Developed and taught a summer course focused on experimental design, data analysis, and scientific writing.
- 2013-2020: As a doctoral student and Postdoc, I mentored 16 undergraduate students and post-baccalaureate technicians, 4 of whom received funding for independent projects. Two direct mentees co-authored a manuscript (or are co-authors on manuscripts in preparation), 4 went on to graduate degrees in related fields.
- 2020: *Guest Lecture*, University of California Davis: Natural History of Insects
- 2014-2019: *Guest Lecturer*, University of Nevada Reno: Range and Forest Plants, Entomology, Neuroscience, How Science Works, Ecology, Plant Biology.
- 2013: *Graduate Teaching Assistant*, University of Nevada Reno Principles of Biological Investigation. Led two lab sections (~45 students). Duties included lecturing, guiding lab activities, and grading writing and speaking assignments.
- 2011-2013: *Director of Environmental Education*, Schrader Environmental Education Center, Wheeling, WV. Helped develop and delivered an inquiry-based environmental education curriculum that spanned two states and served over 1500 students.
- 2011: *Summer Program Specialist*, Schrader Environmental Education Center, Wheeling, WV. Responsible for developing and delivering public programming on natural history, general ecology, invasive species, etc. Directly interacted with more than 2000 members of the public.
- 2010-2011: *Lab Assistant*, University of North Carolina at Asheville. Assisted with the instruction of two lab courses, *Bio 116: Principles of Cellular and Molecular biology* and *Bio 211: Principles of Botany*.

Invited Presentations and Seminars

- March 2023: Florida Atlantic University – invited seminar
- October 2022: Fresno State University – invited seminar
- Nov 2021: Entomological Society of America Annual Meeting, Denver CO. Francis JS, Leonard AS. Invited Oral Presentation. Pollinator nutrition from a plant’s-eye view: Floral reward macronutrients predict patterns of pollen movement in a co-flowering plant community.
- Jan. 2021: Walker Basin Conservancy. Invited Seminar, audience: NGO land managers
- Sept 2020: University of North Carolina at Asheville – invited Seminar.
- Apr 2014: Pacific Branch of the Entomological Society, Tucson AZ. Francis JS. Bumblebees foraging on complex floral rewards.
- Aug 2011: ESA 96th annual meeting, Austin, TX. Organized Oral Session: Pair Power Collaboration with ESA’s Next Generation of Ecologists (i.e. undergraduates) as evidence of Earth Stewardship. Invited Oral Session: J Rhode Ward, JS Francis, JL Horton, and HD Clarke. *Creating a research-infused botanical curriculum at a public liberal arts university*

Professional Presentations

- January 2023: American Society of Naturalists. Asilomar, CA. *Dispersal overwhelms host selection in nectar microbiome community assembly*. **Won best postdoctoral talk.**
- August 2021: Botanical Society of America, Digital Meeting, Francis JS, Mueller TG, Vannette RL. *Intraspecific variation in nectar microbiome among co-occurring cultivars of *Epilobium canum**.
- Aug 2020: Ecological Society of America 104th Annual Meeting. Digital. Francis JS, Leonard AS. Contributed Oral Presentation. *Nutritional neighborhoods: How do rewards mediate associational effects among plants at pollinator-relevant spatial scales?*
- Jan 2020: American Society of Naturalists. Asilomar, CA. Francis JS, Leonard AS. Poster Presentation. *Measuring pollinator-mediated plant associational effects using high resolution aerial imagery*.
- Feb 2019: Gordon Conference on Plant-Herbivore Interaction. Ventura, CA. Francis JS, Muth F, Acevedo CR, Leonard AS. Poster Presentation. *The ecological cost of chemically defended pollen*.
- Aug 2018: Ecological Society of America 103rd annual meeting. New Orleans, LA. Francis JS, Muth F, Leonard AS. Contributed Oral Presentation. *A sweet Solution to the pollen paradox: Can plants overcome the cost of chemically defended pollen?*
- Aug 2017: Ecological Society of America 102nd annual meeting. Portland, OR. Francis JS, Leonard AS. Contributed Oral Presentation. *How do reward composition and floral display shape bumblebee constancy?*
- July 2016: Animal Behavior Society Meeting. Columbia, MO. Francis JS, Muth F, Papaj DR, Leonard AS. *Do ecologically realistic rewards shape pollinator foraging?*
- Aug 2015: Ecological Society of America 100th annual meeting. Baltimore, MD. Contributed Oral Presentation. Francis JS, Muth F, Papaj DR, Leonard AS. *Bumblebees balance colony demand and floral feedback when structuring foraging bouts*.
- Mar 2015: Regional Animal Behavior Student Research Conference. Davis, CA. Oral Presentation. Francis JS. *Nutritional Complexity and the composition and structure of bumblebee foraging bouts*.
- Aug 2014: Ecological Society of America 99th annual meeting. Sacramento, CA. Poster Presentation. Francis JS, Muth F, Papaj DR, Leonard AS. *Separating pollinator constancy into flowers and rewards: A new look at an old phenomenon*.
- Apr 2012: Association of Southeastern Biologists Meeting. Athens, GA. Poster Presentation: Francis JS. *The successes and challenges of creating a cooperative multi-state inquiry-based environmental education curriculum: a case study from northern W. Va and PA*.
- Aug 2011: ESA 96th annual meeting Austin TX. Poster Presentation: JS Francis, and JL Horton. Contributed Oral Presentation. Using Dendroecology to determine the effect of *Celastrus orbiculatus* Thunb. (Oriental bittersweet) on *Liriodendron tulipifera* L. (Tulip poplar) growth.

Mar 2011: National Conference on Undergraduate Research. Ithaca, NY. Oral Presentation:
JS Francis. *Using Dendroecology to determine the effect of Celastrus orbiculatus Thunb.*
(Oriental bittersweet) on *Liriodendron tulipifera* L. (Tulip poplar) growth.

Professional Service

Manuscript reviewer for Ecology Letters, American Journal of Botany, New Phytologist,
Journal of Animal Ecology, Proceedings of the Royal Academy B, American Naturalist,
Ecology, Journal of Applied Ecology, Evolutionary Ecology, Apidologie, Peer J, Journal
of Pollination Ecology, and Journal of Microbial Ecology.

2018-2020: UNR EECB Grants Coordinator.

2016-2017: UNR EECB Colloquium Logistics Committee member.

2015-2017: Organizer of the Plant Animal Interactions Graduate Reading Group (PAInt) at
University of Nevada Reno.

Specialized Training

2018 Short Course of Floral Volatile Collection and Analysis. RMBL, Gothic CO.
(Instructors: Rob Ragusso and Dianne Campbell).

2015 American Museum of Natural History Bee Course. SWRS, Portal AZ.

Skills

Advanced statistical analysis in R

Familiar with Perl, Unix, BUGS, JAGS, SQL

Chemical analysis of nectar with HPLC-UV

Public Presentations

2021: UC Davis Picnic Day, Digital. Collaborative panel discussion of the benefits of
gardening with native plants for pollinator conservation.

2018: “Operation Pollination”, Great Basin Brewery, collaborative hour-long talk with Anne
Leonard and Felicity Muth as part of a program with the US Fish and Wildlife Service,
Nevada Monarch Society, and Nevada Bugs and Butterflies.

2017: “Nevada’s Backyard Bees”, University of Nevada Museum of Natural History’s
National Pollinator Week celebration.

2016: “Our Native Bees”, University of Nevada Museum of Natural History’s National
Pollinator Week celebration.

2015-16: Led two research experiences for Dogherty Science Interns: a collaborative
program with the UNR colleges of Science and Education for pre-service science
teachers.

2015: University of Nevada Museum of Natural History’s National Pollinator Week
celebration.

2015: Public presentation: “Native pollinators of Nevada”. Urban Roots Teaching Farm’s
National Pollinator Week celebration.

- 2014: Public presentation: “Our native pollinators (with a special focus on bees)”. Great Basin Community Food Co-Op National Pollinator week celebrations.
- 2013: Collaborated with Nevada Bugs and Butterflies to present information on pollinators at Terry Lee Wells Nevada Discovery Museum’s pollinator days.
- 2013: Public presentation: “Think small: the interspecific world of plant sex”. Ohio County Master Gardeners.

Additional Outreach and Service

- 2020-2022: Board Member, Davis Bike Collective (focus on increasing gender diversity)
- 2013-2019: Volunteer with Nevada Bugs and Butterflies, helping with public outreach related to native pollinators of Nevada.
- 2009-2011: Multi-year volunteer with the Appalachian Trail Conservancy and the Southern Appalachian Cooperative Weed Management Partnership, helping with mechanical and chemical control of invasive species.
- President (2010-2011 academic year) and Vice President (2009-2010 academic year) of Missing Links Biology Club (University of North Carolina at Asheville).

Professional References

1. Dr. Anne Leonard. *Dissertation advisor*
University of Nevada Reno, anneleonard@unr.edu, 775-784-1932
2. Dr. Matthew Forister *Dissertation committee member*
University of Nevada Reno, mforister@unr.edu, 775-784-6770
3. Dr. Felicity Muth *Collaborator*
University of Texas Austin, felicity.muth@austin.utexas.edu, 520-612-3801
4. Dr. Rachel Vannette *Postdoctoral advisor*
University of California Davis, rlvannette@ucdavis.edu, 530-752-3379