

Candace L. Williams, Ph.D.

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Research achievements in numbers

- **13 papers** in peer-reviewed journals 276 citations, **H-index 9**; Google Scholar)
- **30 invited talks** at national and international conferences or institutions
- **11 research grants** as PI or Co-PI (total funding awarded: ~\$4.2M)
- **22 Trainees** across all appointments

EDUCATION

Mississippi State University:

PhD Molecular Biology, minor: Statistics; August 2015

MS Agricultural Life Sciences, concentration: Biochemistry; August 2011

BS Microbiology, minor: Biology, *magna cum laude*; December 2008

APPOINTMENTS & EXPERIENCE

- 2022- **Senior Researcher**, Recovery Ecology, Beckman Center for Conservation Research, San Diego Zoo Wildlife Alliance
- 2021-2022 **Researcher**, Recovery Ecology, Beckman Center for Conservation Research, San Diego Zoo Wildlife Alliance
Focus: Evaluating microbial drivers of animal fitness to enhance reintroduction outcomes in endangered species.
- 2018-2019 **Visiting Research Fellow**, Division of Microbial Ecology, Centre of Microbiology and Environmental Systems Science, University of Vienna
Focus: Measuring substrate utilization by gut microbiota using isotope- and fluorescence-based labeling tools.
- 2017- **Research Affiliate**, Dorrestein Lab, Skaggs School of Pharmacy & Pharmaceutical Sciences, University of California, San Diego
Focus: Integrating untargeted metabolomics into microbial ecology programs.
- 2015-2021 **Postdoctoral Associate**, Endocrine Unit, Reproductive Sciences, Beckman Center for Conservation Research, San Diego Zoo Wildlife Alliance
Focus: Investigating the role of gut microbiota in phytoestrogen-associated infertility in the white rhinoceros through microbial ecology, analytical chemistry, and molecular endocrinology.
- 2013-2015 **Visiting Scholar**, Suen Lab, Department of Bacteriology, University of Wisconsin-Madison
Focus: Optimizing and conducting parallel sequencing approaches to explore gut microbiomes of obligate herbivores, giant and red pandas.
- 2011 **Visiting Scholar**, Animal Ecology and Conservation Genetics Group, Institute of Zoology, Chinese Academy of Sciences.
Focus: Censusing wild giant panda populations through molecular ecology methods.
- 2009-2015 **Graduate Research Assistant**, Applied Biotechnology Laboratory, Department of Biochemistry, Molecular Biology, Entomology & Plant Pathology, Mississippi State University
Focus: Determined factors that shape the gut microbiota of the giant and red panda, identified contributors to panda gastrointestinal disease through microbiological methods and analytical chemistry and characterized microbial digestion and lipid production for a biofuels platform.

FUNDING (current & pending*)

- 2024-2026 **Co-PI:** "The METSI project - Dynamics of cyanobacteria and toxin production across

- gradients in hydroclimate and elephant pressure on water pans in Botswana,” National Science Foundation, Biodiversity on a Changing Planet Design Track for \$499,961*. PI: Lihini Aluwihare.
- 2023-2028 **PI:** “Restoring microbial function in the Anthropocene,” Austrian Science Fund (FWF) START Programme for 1.2M€.*
- 2023-2024 **Co-PI:** “Population Genomics and Disease Monitoring of the Critically Endangered Mountain Yellow-Legged Frog (*Rana muscosa*),” Morris Animal Foundation and Revive & Restore for \$115,608. PI: Cynthia Steiner.*
- 2022 – 2024 **Co-PI:** “A moving target: movement ecology reimagined,” Gordon and Betty Moore Foundation for \$660,000. PI: Mrinalini Erkenwick Watsa
- 2021 – 2026 **Co-PI:** “Optimizing conservation breeding and reintroductions of mountain yellow-legged frogs in southern California through adaptive management,” United States Fish and Wildlife Service Recovery Challenge Grant for \$2,343,700. PI: Debra Shier
- 2020 – 2022 **Co-PI:** “Understanding and improving disease outcomes during reintroductions of an endangered California amphibian,” Association of Zoos and Aquariums Conservation Grants Fund for \$18,016. PI: Talisin Hammond

FELLOWSHIPS & AWARDS

- 2016 – 2021 Postdoctoral Fellowship, San Diego Zoo Wildlife Alliance, Beckman Center for Conservation Research, USA
- 2015 – 2016 Bud Heller Fellowship, San Diego Zoo Wildlife Alliance, Beckman Center for Conservation Research, USA
- 2009 – 2015 Graduate Student Fellowship, Memphis Zoological Society, USA
- 2007 H. H. Harned Sr. Memorial Scholar (the department’s outstanding microbiology major), Department of Biological Sciences, Mississippi State University, USA.

PUBLICATIONS

[Google Scholar](#) ; [ORCiD](#)

Peer-review

Williams CE, Brown AE, **Williams CL** (2023). The role of diet and phylogeny in shaping the seasonal dynamics of the gut microbiome across animals. Minor revision, *FEMS Microbiology Ecology*.

Williams CE, **Williams CL**, Logan ML (2023). Climate change is more than just global warming: multidimensional impacts on animal gut microbiota[†]. Accepted, *Microbial Biotechnology* DOI: 10.1111/1751-7915.14276 ([link](#)).

Clapham M, Wilson AE, **Williams CL**, Sergiel A (2022). Brown bear skin-borne secretions display evidence of individuality and age-sex variation, *Scientific Reports* 13: 3163 ([link](#)).

Calatayud, NE, Jacobs LE, **Williams CL**, Steiner C, Shier D (2022). Recovering an endangered frog species using integrative reproductive technologies, *Theriogenology* 191: 141-152. ([link](#)) *Invited

Gauglitz JM, West K, Bittremieux W, **Williams CL**, Weldon KC, Panitchpakdi M, Di Ottavio F, Aceves CM, Brown E, Sikora NC, Jarmusch AK, Martino C, Tripathi A, Sayyari E, Shaffer JP, Coras R, Vargas F, Goldasich LD, Schwartz T, Bryant M, Humphrey G, Johnson AJ, Spengler K, Belda-Ferre P, Diaz E, McDonald D, Zhu Q, Nguyen DS, Elijah EO, Wang M, Marotz C, Sprecher KE, Robles DV, Withrow D, Ackermann G, Herrera L, Bradford BJ, Marques LMM, Amaral JG, Silva RM, Veras FP, Cunha TM, Oliveira RDR, Louzada-Junior P, Mills RH, Galasko D, Dulai PS, Kalashnikova TI, Wittenberg C, Gonzalez DJ, Terkeltaub R, Doty MM, Kim JH, Rhee KE, Beauchamp-Walters J, Wright KP, Dominguez-Bello MG, Manary M, Oliveira MF, Boland BS, Lopes NP, Guma M, Swafford AD, Dutton RJ, Knight R, Dorrestein PC (2022). Enhancing untargeted metabolomics using metadata-based source annotation. *Nature Biotechnology* DOI:10.1038/s41587-022-01368-1 ([link](#)).

Jacobs LE, Hammond TT, Gaffney PM, Curtis MJ, Shier DM, Durrant BS, **Williams CL***, Calatayud NE* (2021). Using assisted reproductive technologies to assess the development of secondary sexual characteristics, ovarian senescence, and pseudohermaphroditism in an endangered frog, *Rana*

muscosa, Reproduction, Fertility and Development 33(9) 610-614 ([link](#)). *contributed equally.

Williams CL, Reyero N, Tubbs CW, Martyniuk C, Bisesi JH (2020). Microbiome-endocrine regulation: Perspectives from comparative animal models. *General and Comparative Endocrinology*, 292: 113437 ([link](#)). *Invited

Williams CL, Caraballo-Rodríguez AM, Allaband C, Zarrinpar A, Knight R, Gauglitz JM (2019). Wildlife-microbiome interactions and disease: exploring opportunities for disease mitigation across ecological scales, *Drug Discovery Today: Disease Models*, 28: 105-115 ([link](#)). *Invited

Williams CL, Ybarra AR, Meredith AN, Durrant BS, Tubbs CW. (2019) Gut microbiota and phytoestrogen-associated infertility in southern white rhinoceros, *mBio* 10(2) e00311-19 ([link](#)).

Williams CL, Dill-McFarland KA, Sparks DL, Kouba AJ, Willard ST, Suen G, Brown AE. (2018). Dietary changes during weaning shape the gut microbiota of red pandas (*Ailurus fulgens*). *Conservation Physiology*, 6(1) cox075 ([link](#)).

Williams CL, Dill-McFarland KA, Vandewege M, Sparks DL, Kouba AJ, Willard ST, Suen G, Brown AE. (2016). Dietary shifts may trigger dysbiosis and mucous stools in giant pandas (*Ailuropoda melanoleuca*). *Frontiers in Microbiology*, 7:661 ([link](#)). *Awarded best microbiome paper of 2016 by *Microbiome Digest*.

Calatayud NE, Langhorne CJ, Mullen AC, **Williams CL**, Bullock L, Smith T, Davinroy E, Vance CK, Kouba AJ, Willard ST (2015). The effects of hormone priming regimen on spontaneous oviposition with and without hibernation in the boreal toad (*Anaxyrus boreas boreas*). *Theriogenology*, 84(4): 600-7 ([link](#)).

Williams CL, Willard S, Kouba A, Sparks D, Holmes W, Falcone J, Williams CH, Brown A (2012). Dietary shifts affect the gastrointestinal microflora of the giant panda (*Ailuropoda melanoleuca*). *Journal of Animal Physiology and Animal Nutrition*, 97: 577-585 ([link](#)).

Book chapter

Calatayud, NE, Howell L, Upton R, Tapley B, Johnson K, Browne R, Marcec R, **Williams CL**, O'Brien D, Hobbs R, Trudeau VT, Bower D, Clulow S, Clulow J, Della Tonga G. Amphibian Assisted Reproduction and Biobanking chapter for the IUCN/ASG Amphibian ARTs and Biobanking Working Group. Accepted.

Other

Williams C, Sparks D, Brown A. (2013). Could panda gut microbes power the next-generation biorefinery? *International News on Fats, Oils, and Related Materials*, 24(10) 630-2 ([link](#)). *Invited article

Pre-print

Clapham M, Wilson AE, **Williams CL**, Sergiel A (2022). Brown bear skin-borne secretions display evidence of individuality and age-sex variation, *Research Square*, DOI: 10.21203/rs.3.rs-2087986/v1 ([link](#)).

Gauglitz JM, Bittremieux W, **Williams CL** [...] Dutton RJ, Knight R, Dorrestein PC (2020). Reference data-based insights massively expand understanding of human metabolomes, *bioRxiv* ([link](#)).

Williams CL, Ybarra AR, Meredith AN, Durrant BS, Tubbs CW (2018) Gut microbiota and phytoestrogen-associated infertility in southern white rhinoceros, *bioRxiv* ([link](#)).

In preparation

Williams CL, Williams CE, Imminger S, Gauglitz JM, Herrera MJ, Marshall KL, Belda-Ferre P, Miller M, Buss P, Knight R, Berry D, Dorrestein PC, Tubbs CW (2023) Adaptation to captivity drives rapid changes in the rhinoceros gut microbiome.

Williams CL, Williams CE, King S, Shier D (2023). Environmental change is linked to multi-generational shifts in the gut microbiome that mirror animal health and fitness metrics.

Calatayud, NE, Bragg J, Bruford M, van der Merwe, Brown A, **Williams CL**, Sole C, Hvilsom C, Steiner C, Russo IR (2023). IUCN Species Survival Commission Biobanking Guidelines.

Herrera MJ, Gauglitz JM, Kerr K, Marshall KL, Weldon K, Dorrestein PC, Singleton C, **Williams CL** (2023) Examining the potential of fecal microbiota transplants to treat gastrointestinal imbalance in greater one-horned rhinoceros (*Rhinoceros unicornis*).

Williams CE, Hammer T, **Williams CL** (2024). What makes an animal microbiome healthy? Pre-submission inquiry approved by *ISMEJ*.

Wilson A, Sparks D, **Williams CL**, Knott K, Kouba A, Willard S, Brown A (2024) Changes in the volatile composition of giant panda urine indicate sex, reproductive status, and impending ovulation.

Parascandola C, Gauglitz JM, Felton RG, Weldon K, Tubbs CW, Dorrestein PC, **Williams CL** (2024) Seasonal changes in phytoestrogens and their effect on the rhinoceros gut microbiome.

Wilson AE*, **Williams CL***, Sparks D, Crowe O, Knott K, Willard S, Brown A (2024) Pandas, pheromones, and the pursuit of anatomical estrus cues. *contributed equally.

SUPERVISION OF GRADUATE STUDENTS & POSTDOCTORAL FELLOWS (current)

- 2021 – Spencer Siddons, PhD (Postdoctoral Associate), Recovery Ecology, SDZWA
- 2020 – Claire E. Williams (PhD candidate), Biological Sciences, University of Nevada, Reno, USA
- 2020 – Michelle Herrera (PhD candidate), Ecology and Evolutionary Biology Department, University of California, Irvine, USA
- 2020 – Christine Parascandola, M.S., Veterinary Medicine, Long Island University

TEACHING ACTIVITIES

- 2018 Guest Lecturer – Introduction to Mammalian Microbiomes (HC 209H), Clark Honors College, University of Oregon, USA
- 2017 Guest Lecturer – Integrating Microbial Ecology into Reproductive Sciences, Advanced Inquiry Program, Miami University, USA
- 2015 Instructor – Directed Individual Study (BCH 4003), “Characterizing Ursid Microbiomes,” Department of Biochemistry and Molecular Biology, Mississippi State University, USA
- 2012 Guest Lecturer – General Biochemistry I (BCH 4603/6603), Department of Biochemistry and Molecular Biology, Mississippi State University, USA
- 2011 Guest Lecturer – Principles of Biochemistry (BCH 4603/6013), Department of Biochemistry and Molecular Biology, Mississippi State University, USA

ORGANIZATION OF SCIENTIFIC MEETINGS

- 2022 Symposium organizer/convener, American Society for Microbiology’s Microbe 2022, entitled, “Gut microbiome rewilding: theory and limitations.”
- 2022 Host/Organizer, Joint symposium with Smithsonian Conservation Biology Institute, entitled, “Microbial contributions to wildlife conservation”
- 2021 Fast Track organizer/convener, World Microbe Forum, entitled, “Toward a mechanistic understanding of wildlife-microbiome interactions.”
- 2018 Symposium organizer/convener, American Society for Microbiology’s Microbe 2018, entitled, “Integrating microbial ecology into threatened wildlife management.”
- 2017 Symposium organizer/convener, American Society for Microbiology’s Microbe 2017, entitled, “Conserving wild animal microbiomes of endangered species.”

INSTITUTIONAL RESPONSIBILITIES

- 2021 – Member, Conservation Technology Taskforce, SDZWA, USA
- 2021 – Member, Savanna Hub Working Group, SDZWA, USA

- 2021– Leader, Wild Microbiomes Working Group
 2020 – Member, Early Career Researcher Group, SDZWA, USA
 2020 Organizer, Conservation Science Seminar Series, SDZWA, USA
 2015 – Member, Northern White Rhinoceros Working Group, SDZWA, USA
 2016 – 2018 Member, Diversity and Inclusion Committee, SDZWA, USA

MEMBERSHIPS OF SCIENTIFIC SOCIETIES

- 2013 – Member, American Society for Microbiology
 2017 – Member, International Society for Microbial Ecology
 2020 – Member, Association of Zoos and Aquariums

COLLABORATIONS (current)

Pieter Dorrestein, PhD, University of California, San Diego. Integrating metabolomics into wildlife microbial ecology [2017 – present].

Rob Knight, PhD, University of California, San Diego. Expanding microbiome methods for wildlife in human care [2017 – present].

Michele Miller, PhD/DVM, Stellenbosch University, and **Peter Buss, PhD/DVM**, South Africa National Park Service). Evaluating wild rhino microbiomes and their link to health [2017 – present].

David Berry, PhD, University of Vienna. Measuring the potential of rhinoceros gut microbiota to transform phytoestrogens *in vitro* [2018 – present].

Ungulate Lactation Consortium (project lead) with **Lars Bode, PhD, Rob Knight, PhD, Pieter Dorrestein, PhD, Itay Budin, PhD** from University of California, San Diego, **Christian Metallo, PhD** from Salk Institute for Biological Studies, and **Michael Power, PhD** from Smithsonian Conservation Biology Institute. From milk to microbes: enhancing assist-rearing outcomes in African elephants (*Loxodonta africana*) through a multidisciplinary approach [2018 – present].

Mrinalini Erkenwick Watsa, PhD, San Diego Zoo Wildlife Alliance & Field Projects International. Developing field genomics methods for *in situ* conservation programs [2020 – present].

Mike Logan, PhD, University of Nevada, Reno. Understanding mechanisms of adaptation in Neotropical Anolis lizards. [2022 – present].

REFERENCES

Advisors & supervisors

- Supervisor Dr. Debra Shier, San Diego Zoo Wildlife Alliance | dshier@sdzwa.org
 Postdoctoral Dr. Christopher Tubbs, San Diego Zoo Wildlife Alliance | ctubbs@sdzwa.org
 MS & PhD Dr. Ashli Brown, Mississippi State University | abrown@mssl.msstate.edu
 & Dr. Darrell Sparks, Mississippi State University | dsparks@bch.msstate.edu
 BS Dr. Karen Coats, University of Southern Mississippi [current] | Karen.Coats@usm.edu

Additional references

- Dr. Rob Knight, University of California, San Diego | robknight@eng.ucsd.edu
 Dr. David Berry, University of Vienna | david.berry@univie.ac.at
 Dr. Pieter Dorrestein, University of California, San Diego | pdorrestein@health.ucsd.edu
 Dr. Garret Suen, University of Wisconsin-Madison | gsuen@wisc.edu
 Dr. Scott Willard, Mississippi State University | swillard@cals.msstate.edu
 Dr. Michele Miller, Stellenbosch University | miller@sun.ac.za
 Dr. Oliver Ryder, San Diego Zoo Wildlife Alliance | oryder@sdzwa.org