

PATRICK GORRING, PHD

Curator of Coleoptera and Odonata
Florida State Collection of Arthropods
FL Dept. of Ag. and Consumer Services
sites.google.com/view/patrickgorring/

1911 SW 34th St
Gainesville, FL 32608
USA
Patrick.Gorring@fdacs.gov

Born Wayne, Michigan; U.S. Citizen

Research Interests

Ecology and evolution of plant-insect systems; diagnostic tools; collections; macroevolution; host-nematode interactions; speciation and evolutionary diversification; evolution of beetle chemical communication; biogeography; phylogenetics/genomics; biodiversity genomics; taxon description

Positions

Florida Department of Agriculture and Consumer Services, Florida State Collection of Arthropods

(2024-present) **Research Scientist: Curator of Coleoptera and Odonata**

Michigan State University

(2024-present) **Curator of Insect DNA and Coleoptera**, MSU Department of Entomology

(2019-2024) **Research Associate**, MSU Department of Entomology

Harvard University

(2019-present) **Associate**, Department of Organismic and Evolutionary Biology

Education

Harvard University, Graduate School of Arts and Sciences, Cambridge, MA 2010-2019

Ph.D. Department of Organismic and Evolutionary Biology, April 2019

Advisor: Dr. Brian Farrell

Cornell University, College of Human Ecology, Ithaca, NY 2005-2009

B.S. Major: Human Biology, Health and Society, Minor: Entomology, May 2009

Honors in leadership

University Honors and Awards

- **Outstanding Postdoc** award, Michigan State Entomology (2023-24)
- Bok Center Certificate of **Teaching Excellence**, Harvard University (2015, 2016)
- Harvard Prize Fellowship, full tuition support (2010-16)
- Recognized as an elite contributor to the **campus community**, five seniors chosen that exemplify dedication and commitment to the betterment of Cornell University (2009)
- Chosen as a Cornell Meinig Family National Scholar of **leadership**, 50 students/class (2005-2009)
- Federal Smart Grant for academic excellence-Cornell (07-09)
- Recognized as a Cornell College of Human Ecology Scholar (2005-09)
- Varsity Letterman in Football (2007-08)

Grants Awarded (~\$840,000)

- USDA Farmbill. A. Cognato PI. Revision of *Euwallacea* species limits for improved diagnostics of potential invasive species. Michigan State University ~\$250,000 (2022-2024)
*PSG Co-writer of proposal, postdocs not allowed be a PI under MSU regulations
- NSF DBI Standard Grant, **co-PI**. Towards a sustainable management of insect collections in the U.S. through the Entomological Collections Workshop. \$99,000 (2021-2024)
- USDA Farmbill. A. Cognato PI. Morphological and molecular diagnostic tools for larval and adult softwood longhorned beetles. Michigan State University ~\$400,000 (2018-2023)
*PSG writer of grant proposal, postdocs not allowed be a PI under MSU regulations
- Harvard Milton Fund, **co-PI**. Brian D. Farrell PI. Evolution of plant-beetle interactions and next generation sequencing. \$40,000 (2014-15)
- Huron Mountain Wildlife Foundation Research Grant, multiple projects as **PI**, \$18,000 (2012-pres.)
- Goelet Research Award, **PI**, Harvard Museum of Comparative Zoology \$2500 (2015)
- Barbour collections improvement grant, **PI**, *Monochamus* genomics. Harvard MCZ \$6840 (2015)
- Graduate Student Council Conference travel grant \$750 (2014)
- David Rockefeller Center for Latin American Studies travel grants \$1650 (2011,13,17)
- Putnam Expedition Grant, **PI**, SW USA fieldwork, Museum of Comparative Zoology \$4,120 (2013)
- Cornell Meinig National Scholar Grant, Insect Taxonomy in Ecuador \$4000 (2008)

Appointments

- Postdoctoral representative to Michigan State University Entomology Faculty (2022-present)
- Graduate Student Associate, Harvard Rockefeller Center for Latin American Studies (2015-16)

Relevant Training

- Entomology Collections Management Workshop (2017)
- Graduate-level courses in entomology, evolution, and statistics (Cornell & Harvard)
- Teaching volunteer in immature insects course, Michigan State (2022)
- Lab instructor (collection-based) for insect biology course at Harvard (2011,13)
- Weevil Identification Course, Southwest Research Station (2012)
- Arborist tree climbing certification (2016)
- Animal macrophotography training and tropical fieldwork, The Biodiversity Group (2008)

Publications

- Gorring, P. & Farrell, B. 2023. *Evaluating species boundaries using coalescent delimitation in pine-killing *Monochamus* (Coleoptera: Cerambycidae) sawyer beetles*. **Molec. Phylogenetics & Evolution** 184: 10777. <https://doi.org/10.1016/j.ympev.2023.107777>
- Gorring, P. & A. Cognato. 2023. *The case for a nuclear barcode: using the CAD CPS region for species and genus level discrimination in beetles*. **Diversity** 15(7), 847. <https://doi.org/10.3390/d15070847>
- Karpiński, L. **Gorring, P.** Cognato, A.I. 2023. *DNA vs. Morphology in Delineating Species Boundaries of Endemic Mongolian Eodorcadion Taxa (Coleoptera: Cerambycidae)*. **Diversity** 15(5), 662. <https://doi.org/10.3390/d15050662>
- Karpiński, L. **Gorring, P.** Hilszczański, J. Szczepański, W.T. Plewa, R. Łoś, K. & Cognato, A.I. 2022. *Integrative taxonomy tests possible hybridisation between Central Asian cerambycids (Coleoptera)*. **Zoologica Scripta** 52(1), 70–85. <https://doi.org/10.1111/zsc.12570>
- Karpinski, L. **Gorring, P.** Kruszelnicki, L., Kasatkin, D., & Szczepanski, W. 2021. *A fine line between species and ecotype: a case study of *Anoplistes halodendri* and *A. kozlovi* occurring sympatrically in Mongolia (Coleoptera: Cerambycidae)*. **Arthropod Systematics & Phylogeny** 79: 1-23. <https://doi.org/10.3897/asp.79.e61499>

Gorring, P. 2019. *Gene to Genus: Systematics and Population Dynamics in Lamiini Beetles (Coleoptera: Cerambycidae) With Focus on Monochamus Dejean*. PhD Dissertation. Harvard University. <http://nrs.harvard.edu/urn-3:HUL.InstRepos:42029751>

In prep:

Gorring, P. & Farrell, B. *Not geography but climate influences population structure of sky island pine beetles (Cerambycidae: Monochamus) in the Great Basin of North America*

Gorring, P. *Diversification through ice age allopatry and major host plant shifts in Northern Hemisphere Monochamus pine sawyer beetles.*

Gorring, P. & Farrell, B. *Multigene phylogeny of the Lamiini and related tribes (Coleoptera: Cerambycidae) reveals polyphyly prompting a revised tribal classification.*

Gorring, P. & A. Cognato. *Efficient trapping methods for Monochamus beetles and pheromone attractiveness to relatives worldwide.*

Nganhane, I. & **Gorring, P.** *Phytophagous beetles as a bio-indicator: the longhorned beetles of Mozambique's Gorongosa National Park (Coleoptera: Cerambycidae).*

Gorring, P. *Evidence for a subsocial species of mantid in Thailand.*

Gorring, P. & Eldredge, T. *A new species of Cubanotyphlus (Coleoptera: Staphylinidae) from imperiled southern Texas forest remnants.*

Other peer-reviewed scholarly products

Gorring, P., S.M. Smith, A.I. Cognato, and A.J. Redford. 2022. *CerambycID*. USDA APHIS Identification Technology Program (ITP), Fort Collins, CO and Michigan State University. <https://idtools.org/wbb/cerambycid/>

Research

Museomics of dried beetles with target enrichment to explore phylogeny and diversification

Collaborator: Dr. Anthony Cognato *current*

We are extracting DNA from longhorned and ambrosia beetles up to 100 years old. Using probes, we enrich the degraded DNA for a set of genes and sequence hundreds of specimens together. This enables species-level phylogenetic work to explore beetle-host relationships, revise taxonomy, and enable the diagnosis of potentially invasive species.

Building molecular and morphological identification tools for conifer and invader Cerambycidae

Collaborators: Dr. Anthony Cognato, Dr. Sarah Smith *2018-present*

No worldwide resource is available to identify conifer feeding and invader longhorned beetles. We built a verified DNA database of multiple diagnostic genes and morphology diagnostic tools in a matrix-based key for Cerambycidae genera worldwide. The resources are integrated with images on a custom website. Larvae and adults are treated. <https://idtools.org/wbb/cerambycid/>

USDA-APHIS MoU partnership, Cerambycidae ID and sequencing

2015-present *Dr. Hannah Nadel, Dr. Yunke Wu*

This collaboration was formed with APHIS to identify cerambycid beetles intercepted at ports in softwood packing material. Highlights are molecular identification of larvae and adults, morphological confirmations and development of morphological identification tools for general use.

Milkweed longhorn beetle phylogenetics and defense escalation

Collaborators: Brian Farrell & Sang Kim (Harvard), Anurag Agrawal (Cornell) *current*

Milkweed beetles can eat leaves of plants with toxic cardiac glycosides, heart-stopping chemicals. By building a phylogeny and mapping the plants of differing defense amounts we are testing hypotheses of defense escalation and escape-radiate adaptation.

Phytophagous beetle transcriptomics for evolutionary ecology *current*

I am actively using transcriptomes that I have built (over 70) to explore the genetic relationships of phytophagous beetles, build a set of enrichment loci, and describe gene families for olfaction and plant chemical metabolism. This is leading to the study of beetle host finding, defense, chemical avoidance, and invasion potential.

Systematics and population dynamics of *Monochamus* beetles and relatives, PhD project

2011-2019

Dr. Brian Farrell, advisor

My dissertation project focused on the evolutionary history of sawyer beetles (Cerambycidae: *Monochamus*) and their tribal relatives. Results show that *Monochamus sensu lato* is a lumping of many disparate genera and the tribe Lamiini includes many other tribes. Comparing *Monochamus* transcriptomes at the population level shows that sky island geography in the Great Basin does not isolate populations and isolation by climate explains most of their differentiation.

Gorongosa National Park Bioinventory Project, Mozambique

2014-present

Dr. Piotr Nasckrecki, Dr. E.O. Wilson

The restoration of Gorongosa National Park began in 2012 with EO Wilson. I surveyed beetles for the park and started building the beetle section of their insect collection. This included databasing the specimens using a Filemaker-based relational database (Mantis). I trained young Mozambican students in curation, entomology, and faunistics. Projects on fauna and longhorned beetles as bioindicators of forest health have stemmed from this.

Beetle Trapping, Survey, and sequencing studies, Huron Mountain Club, Michigan

2012-present

Independent project

This project explores the phytophagous beetle fauna of virgin and old growth forest in Michigan's Upper Peninsula. The ongoing survey uses various collecting methods including chemical lures and canopy traps. A trapping study was conducted in pine woodland to compare the efficacy of lures on pine sawyers and to determine the effects of tree removal. Survey specimens are being used to support Chrysomeloidea transcriptome sequencing and natural history museomics efforts.

All Taxa Bioinventory of the Boston Harbor Islands National Recreation Area

2010-2019

Dr. Jessica Rykken, Harvard University

This long-term project has the goal of identifying all the multicellular organisms present on the Harbor islands. I contributed through bee surveys, a photo blitz experiment, and identifying beetle material.

Developmental allometry comparison of social and solitary huntsman spiders (Sparassidae)

Spring 2009

Dr. Linda Rayor, Cornell University

Although the adults of ten species of sympatric Australian huntsman spiders are similar in body mass and allometry, there are major differences in the rates and patterns of growth between two social and eight solitary species. To quantify these patterns I collected detailed morphological measurements and body weights of instars of each species to quantify the differences.

Investigation of hybridization in genus *Ceuthophilus* (Orthoptera: Rhaphidophoridae)

Summer 2010

Dr. Ted Cohn

Large cave crickets in *Ceuthophilus* show fixed morphology in two habitats and also a third form which is intermediate in genital morphology. Specialized field sampling was done to sample across the putative hybrid zone. Based on preliminary data, hybrid speciation may have formed a stable third sp.

Insect Intern, The Biodiversity Group, Ecuador

Summer 2008

Dr. Paul Hamilton

Broadened diversity survey by capturing, photographing and cataloging stick insects and herpetofauna in threatened habitat in western Ecuador. Contributed specimens to Phasmida research projects.

Presentations

- Gorring, P.S. 2023. Entomological Society of America, paper presentation: *Molecular delimitation in diverse groups: Optimizing data and analysis*. ESA National Meeting, National Harbor, MD
- Gorring, P.S. 2022. Entomological Society of America, paper presentation: *The successful use of multigene enrichment museomics to broaden longhorned beetle (Cerambycidae) systematics*. ESA National Meeting, Vancouver, BC
- Gorring, P. 2020. **Invited seminar**. Michigan State University Department of Entomology. *Gene to Genus: the use of population and phylogenetic methods to address diversity in longhorned beetles (Coleoptera: Cerambycidae)*.
- Gorring, P. & Kanda, K. 2019 **Symposium Organizer**, Entomological Collections Network: *Specimen Preservation in the 21st century: Getting the most data from collecting efforts*.
- Gorring, P.S. 2019. Entomological Society of America: *Island hopping? Population dynamics of Monochamus clamator in the Great Basin sky islands*. ESA National Meeting, St. Louis, MO
- Gorring, P.S. 2018. Entomological Society of America: *Dealing with diversity: Systematics lessons provided by Monochamus and relatives*. ESA National Meeting, Vancouver, BC
- Gorring, P.S. 2016. International Congress of Entomology. *Systematics and host use in the Lamiini and Monochamus beetles*. ICE meeting, Orlando, FL.
- Gorring, P.S. 2014. Entomological Society of America student paper competition oral presentation: *The case for Monochamus: Preliminary evidence*. ESA National Meeting, Portland, OR.
- Gorring, P.S. 2014. Harvard G4 Symposium. *Sky island living: What inspired pine sawyer beetle diversification?* American Academy for the Advancement of Science, Cambridge, MA.
- Gorring, P.S. 2013. Entomological Society of America student paper competition oral presentation: *You thought these beetles were just boring: Systematics of the sawyers (Cerambycidae: Monochamus)* ESA National Meeting, Austin, TX.
- Gorring, P.S. 2013. Cambridge Entomological Club presentation: *The life and times of local Insects*. Cambridge, MA.
- Gorring, P.S. 2011. Entomological Society of America poster presentation: *Where do conifer insects come from?* ESA National Meeting, Reno, NV.

Employment/Teaching Experience

Research Associate, Michigan State University, Supervisor Dr. Anthony Cognato
2019-2024

Supported by consecutive USDA Farmbill grants, this research-focused position is centered on delineating beetle species and producing tools to identify species and higher taxa of longhorn and ambrosia beetles. Taxon delimitation, phylogeny, and ID tool creation were possible by using museomic molecular methods and morphological techniques.

Course Head, Plant-Animal Interaction field course, Mozambique
Spring 2016

I developed this course for Mozambican university and graduate students. It was a week-long intensive field course set at Gorongosa National Park that included lectures, projects and observation.

Co-instructor, OEB399, Graduate Student Professional Development, Harvard University
Fall & Spring 2015/16 With Glenna Clifton

We organized professional development instruction and faculty interaction for new PhD students.

Lab instructor, LS2, Human Anatomy & Physiology, Harvard University
Fall 2017, 2018 Dr. George Lauder

I managed over 50 students each year in lab sections in anatomy through dissection and physiology through experimentation.

Lab instructor, Bio-E65, Human Anatomy & Physiology, Harvard Extension School

Spring, Fall, 2018

Dr. Jennifer Carr

I managed approx. 30 students each semester in lab sections in anatomy through dissection and physiology through experimentation.

Lab instructor, OEB10, Foundations of Biological Diversity, Harvard University

Fall 2014

Dr. Brian Farrell

This is an introductory course in the biology of organisms. I instructed a lab section.

Teaching Fellow, OEB55, Ecology, Harvard University

Spring 2015, 2017

Drs. Paul Moorcroft and Collin Johnson

Responsible for teaching a discussion section of students and leading fieldtrips in introductory ecology.

Teaching Fellow, OEB155R, Insect Biology, Harvard University

Fall 2011, 2013

Drs. Naomi Pierce and Michael Canfield

As teaching assistant, I shared my passion for insects with an excited group of students.

Responsibilities- teaching a systematic lab, taking students out into the field for collection and natural history observation.

Curatorial Assistant, UMMZ Insect Collection, University of Michigan

8/09-8/2010

Mark O'Brien, Coll. Manager

Curatorial work including databasing (Filemaker based) and moving dry and wet arthropod collections. Arthropod mounting, labeling, and identification to species level. Interaction with faculty curators and the public.

Field Experience

- Experience planning for small group travel on five continents and in different languages
- Fieldwork countries include Vietnam, Mozambique, Ecuador, Thailand, Korea, and extensive work (> 10 months' time) across the United States.
- Museum and field connections have been established in additional countries.

Leadership Activities

- Treasurer, Entomological Collections Network, ECN (2016-present)
- Virtual conference organizer, Entomological Collections Network, 450 attendees (2020, 2021)
- Symposium organizer, Entomological Collections Network meeting (2019)
- Treasurer, Cambridge Entomological Club (2013-17)
- President, Cambridge Entomological Club (2012-13)
- Vice President, Cambridge Entomological Club (2011-12)
- Executive Board Member, Cornell Meinig National Scholars (2006-2008)
- Vice President, 'Snodwigs' Cornell University Undergraduate Entomology Club (07-08)

Service

- Curatorial work in many insect collections (ongoing)
- Reviewer, Biodiversity Data Journal (2023)
- Review editor, Insecta Mundi (2020-present)
- Reviewer, Entomologia Experimentalis et Applicata (2019)
- Proposal reviewer, Graduate Women in Science National Fellowships program (2019)

Mentorship

- Mentor of Fulbright Scholar Dr. Lech Karpinski, Poland, in molecular methods (2022-23)
- Supervised/trained undergraduate Taylor Hori on larval beetle imaging project (2022-23)
- Co-advisor of MSU Masters Student Ellen Camerato for Cerambycidae projects (2019-2021)
- Advised Harvard Undergraduate Ryan Friedman on beetle taxonomy/sequencing project (2017)
- Advised Mozambican student I. Nganhane, African Cerambycidae faunistics (defended 2015-16)

- Mentored Harvard undergraduate Sangil Kim on systematics thesis (2013-15)

Community Outreach

- Team lead at Kellogg Bird Sanctuary **Bioblitz**, insects on trees (2023-24)
- Science Olympiad regional event volunteer (2020-23)
- Public and private **tour guide** to the beetle collection of over 3.5 million specimens at Harvard University (2010-2019)
- Steering member and participant: **Inaugural National Park Photoblitz**, Boston Harbor Islands National Park, MA. (2013)
- Co-Organizer of Hogback Mt. **all taxon survey**, Hogback Mountain, VT. (2018)
- Organizer of Wachusett Mountain **Bioblitz**- insect leader, Wachusett Mountain, MA. (2011-2019)
- Collector and contributor to the **All Taxa Bioinventory** of the Boston Harbor Islands, Boston, MA. Identified, collected and presented to the public. (2010-2011)
- Great Basin National Park **Bioblitz** participant, beetle specialist (2013)
- Beetle member of **biodiversity survey** group on the Navajo Nation in the U.S. The group teaches, trains and works alongside native students. (2011-2018)
- Insect diversity presenter, Harvard Museum of Natural History's 'Insect Planet' program, **presented insects to over 1000 people** through this museum program. (2011)
- Team Leader, Rouge River insect survey, **led citizen scientists** in collection of aquatic insects measuring water quality in a recovering Detroit area river system (2010)
- Planning committee and **presenter to 3000+ community members** at Insectapalooza, 1-day insect fair hosted by Cornell Entomology. (2007, 08)
- Attendee and mentor for the Society for the Advancement of Chicanos and Native Americans in Science conference. A conference bringing together over 4000 individuals for the purpose of increasing recognition of underrepresented groups in science. (2011-2016)
- Leader of insect parties for children, generating arthropod excitement in 3-7 year olds (2009)

Campus Activities

- Developed Harvard collections and taxonomy journal and seminar group (2018-19)
- Co-organizer, Phylogenetics Journal Club (2012-18)
- Dubois Society, Harvard minority organization member (2011-18)
- Executive board member (President, VP, Treasurer), Cambridge Entomological Club (2010-17)
- Harvard graduate orchestra, lead tuba player (2012-15), Group winner of American Music Prize
- Coach, Harvard youth wrestling program (2012-17)
- Meinig Family National Scholar, small (200) group of leaders recognized on Cornell campus (05-09)