

# MAREK L. BOROWIEC

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Assistant Professor ◊ Colorado State University ◊ Fort Collins, CO 80523, USA

website: [phylohacks.org](http://phylohacks.org)

## EDUCATION

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- Arizona State University, Tempe, USA** 2016 – 2018  
Postdoctoral Scholar  
Genomics of speciation and evolution of social parasitism in *Formica* ants  
Advisor: Christian Rabeling
- University of California, Davis, USA** 2010 – 2016  
Ph.D. in Entomology  
Dissertation: Systematic and phylogenomic studies on the ant subfamily Dorylinae, and a phylogenetic investigation of early branching lineages of ants (Hymenoptera: Formicidae)  
Advisor: Philip S. Ward
- University of Wrocław, Poland** 2007 – 2009  
M.Sc. in Zoology  
Thesis: Taxonomy of the *Cerapachys sexspinus* species-group  
Advisor: Wanda Wesółowska
- University of Wrocław, Poland** 2005 – 2007  
B.Sc. in Biological Sciences/Zoology

## EMPLOYMENT

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- Colorado State University, Fort Collins, USA** 2022 – present  
Assistant Professor  
Director, C. P. Gillette Museum of Arthropod Diversity
- University of Idaho, Moscow, USA** 2019 – 2022  
Assistant Professor

## PUBLICATIONS

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**1,301 citations | h-index: 15, i10-index: 23 | Source: [Google Scholar](https://scholar.google.com/citations?user=7111111111111111) 30 August 2022**

Submitted:

2. Sosiak C. E., **Borowiec M.L.**, Barden P. 2022. An Eocene army ant. Submitted to *Biology Letters*.
1. Johnson R.A., **Borowiec M.L.**, Snelling R.R., Cole A.C. 2022. A taxonomic revision and a review of the biology of the North American seed-harvester ant genus *Veromessor* (Hymenoptera: Formicidae: Myrmicinae). Accepted in *Zootaxa*.

Published:

40. **Borowiec M.L.**, Dikow R.B., Frandsen P.B., McKeeken A., Valentini G., White A.E. 2022. Deep learning as a tool for ecology and evolution. *Methods in Ecology and Evolution*, 13(8): 1640–1660. [doi:10.1111/2041-210X.13901](https://doi.org/10.1111/2041-210X.13901).
39. Romiguier J., **Borowiec M.L.**, Weyna A., Helleu Q., Loire E., La Mendola C., Rabeling C., Fisher B.L., Ward P.S., Keller L. 2022. Ant phylogenomics reveal a natural selection hotspot preceding the origin of advanced eusociality. *Current Biology*, 32(13): 2942–2947. [doi:10.1016/j.cub.2022.05.001](https://doi.org/10.1016/j.cub.2022.05.001)

38. Boudinot B.E., **Borowiec M.L.**, Prebus M.M. 2022. Phylogeny, evolution, and classification of the ant genus *Lasius*, the tribe Lasiini, and the subfamily Formicinae (Hymenoptera: Formicidae). *Systematic Entomology*, 47(1): 113–151. doi:10.1111/syen.12522.
37. Purcell J., Lagunas-Robles G., Rabeling C., **Borowiec M.L.**, Brelsford A. 2021. The maintenance of polymorphism in an ancient social supergene. *Molecular Ecology*, 30(23): 6246–6258. doi:10.1111/mec.16196.
36. **Borowiec M.L.**, Cover S.P., Rabeling C. 2021. The evolution of social parasitism in *Formica* ants revealed by a global phylogeny. *Proceedings of the National Academy of Sciences of the USA*, 118(38): e2026029118. doi:10.1073/pnas.2026029118.
35. Dilworth K.A., **Borowiec M.L.**, Cohen A.L., Mickelson G.S., Oeller E.C., Crowder D.W., Clark R.E. 2021. Ants of the Palouse Prairie: diversity and species composition in an endangered grassland. *Biodiversity Data Journal*, 9: e65768. doi:10.3897/BDJ.9.e65768
34. Hotaling S., **Borowiec M.L.**, Lins L.S.F., Desvignes T., Kelley J.L. 2021. The biogeographic history of eelpouts and related fishes: linking phylogeny, environmental change, and patterns of dispersal in a globally distributed fish group. *Molecular Phylogenetics and Evolution*, 162: 107211. doi:10.1016/j.ympev.2021.107211.
33. van Elst T., Eriksson T.H., Gadau J., Johnson R.A., Rabeling C., Taylor J.E., **Borowiec M.L.** 2021. Comprehensive phylogeny of *Myrmecocystus* honey ants highlights cryptic diversity and infers evolution during aridification of the American Southwest. *Molecular Phylogenetics and Evolution*, 155: 107036. doi:10.1016/j.ympev.2020.107036.
32. Csősz S., Seifert B., Mikó I., Boudinot B., **Borowiec M.**, Fisher B., Prebus M., Puniamoorthy J., Rakotonirina J.C., Rasoamanana N., Schultz R., Trietsch C., Ulmer J., Elek Z. 2021. Insect morphometry is reproducible under average investigation standards. *Ecology and Evolution*, 11: 547–559. doi:10.1002/ece3.7075.
31. **Borowiec M.L.**, Moreau C., Rabeling, C. 2020. Ants: phylogeny and classification. In: ed. C.K. Starr, *Encyclopedia of Social Insects*. Cham, Switzerland: Springer, pp. 56–69. doi:10.1007/978-3-319-90306-4\_155-1.
30. **Borowiec M.L.** 2019. Spruceup: fast and flexible identification, visualization, and removal of outliers from large multiple sequence alignments. *Journal of Open Source Software*, 4(42): 1635. doi:10.21105/joss.01635.
29. **Borowiec M.L.**, Rabeling C., Brady S.G., Fisher B.L., Schultz T.R., Ward P.S. 2019. Compositional heterogeneity and outgroup choice influence the internal phylogeny of the ants. *Molecular Phylogenetics and Evolution*, 134: 111–121. doi:10.1016/j.ympev.2019.01.024.
28. **Borowiec M.L.** 2019. Convergent evolution of the army ant syndrome and congruence in big-data phylogenetics. *Systematic Biology*, 68(4): 642–656. doi:10.1093/sysbio/syy0884.
27. Gillung J.P., Winterton S.L., Bayless K.M., Khouri Z., **Borowiec M.L.**, Yeates D., Kimsey L.S., Misof B., Shin S., Zhou X., Mayer C., Petersen M., Wiegmann B.M. 2018. Anchored phylogenomics unravels the evolution of spider flies (Diptera, Acroceridae) and reveals discordance between nucleotides and amino acids. *Molecular Phylogenetics and Evolution*, 128: 233–245. doi:10.1016/j.ympev.2018.08.007.
26. Kjer K., **Borowiec M.L.**, Frandsen P., Ware J., Wiegmann B.M. 2016. Advances using molecular data in insect systematics. *Current Opinion in Insect Science*, 18: 40–47. doi:10.1016/j.cois.2016.09.006.
25. **Borowiec M.L.** 2016. Generic revision of the ant subfamily Dorylinae (Hymenoptera, Formicidae). *ZooKeys*, 608: 1–280. doi:10.3897/zookeys.608.9427.
24. **Borowiec M.L.** 2016. AMAS: A fast tool for alignment manipulation and computing of summary statistics. *PeerJ*, 4:e1660. doi:10.7717/peerj.1660.
23. **Borowiec M.L.**, Lee E.K., Chiu J.C., Plachetzki D.C. 2015. Extracting phylogenetic signal and accounting for bias in whole-genome data sets supports the Ctenophora as sister to remaining Metazoa. *BMC Genomics*, 16(1): 987. doi:10.1186/s12864-015-2146-4.
22. **Borowiec M.L.**, Kimsey, L.S. 2015. The first host record for the wasp subfamily Brachycistidinae (Hymenoptera: Tiphidae). *Proceedings of the Entomological Society of Washington*, 117(1): 62–64. doi:10.4289/0013-8797.117.1.62.
21. Snelling R.S., **Borowiec M.L.**, Prebus M.M. 2014. Studies on California ants: new species in the genus *Temnothorax* Mayr (Hymenoptera: Formicidae). *ZooKeys*, 372: 27–89. doi:10.3897/zookeys.372.6039.

20. Johnson B.R., **Borowiec M.L.**, Chiu J.C., Lee E.K., Atallah J., Ward P.S. 2013. Phylogenomics resolves evolutionary relationships among ants, bees, and wasps. *Current Biology*, 23: 2058–2062. [doi:10.1016/j.cub.2013.08.050](https://doi.org/10.1016/j.cub.2013.08.050).
19. **Borowiec M.L.**, Borowiec L. 2013. New data on the occurrence of ants (Hymenoptera: Formicidae) in Lower Silesia and other regions of Poland [in Polish with English summary] *Wiadomości Entomologiczne*, 32: 49–57. [link](#).
18. **Borowiec M.L.** 2013. Two species of myrmecophilous Diapriidae (Hymenoptera) new to Poland. *Wiadomości Entomologiczne*, 32: 42–48. [link](#).
17. **Borowiec M.L.**, Wiśniowski B., Żyła W. 2012. *Xenos vesparum* Rossius, 1793 - a strepsipteron new to Poland (Strepsiptera: Xenidae) *Acta Musei Moraviae, Scientiae Biologicae*, 97: 7–12. [link](#).
16. **Borowiec M.L.** 2012. New record of *Elenchus tenuicornis* (Kirby, 1815) (Strepsiptera: Elenchidae) in Poland [in Polish] *Wiadomości Entomologiczne*, 31: 210. [link](#).
15. Seltmann K.C., Yoder M.J., Mikó I., Forshage M., Bertone M.A., Agosti D., Austin A.D., Balhoff J.P., **Borowiec M.L.**, Brady S.G., Broad G.R., Brothers D.J., Burks R.A., Buffington M.L., Campbel H.M., Dew K.J., Ernst A.F., Fernández-Triana J.L., Gates M.W., Gibson G.A.P., Jennings J.T., Johnson N.F., Karlsson D., Kawada R., Krogmann L., Kula R.R., Mullins P.L., Ohl M., Rasmussen C., Ronquist F., Schulmeister S., Sharkey M.J., Talamas E., Tucker E., Vilhelmsen L., Ward P.S., Wharton R.A., Deans A.R. 2012. A hymenopterists' guide to the Hymenoptera Anatomy Ontology: utility, clarification, and future directions. *Journal of Hymenoptera Research*, 27: 67–88. [doi:10.3897/jhr.27.2961](https://doi.org/10.3897/jhr.27.2961).
14. Wetterer J.K., Kronauer D.J.C., **Borowiec M.L.** 2012. Worldwide spread of *Cerapachys biroi* (Hymenoptera: Formicidae: Cerapachyinae). *Myrmecological News*, 17: 1–4. [link](#).
13. **Borowiec M.L.**, Longino J.T. 2011. Three new species and reassessment of the rare Neotropical ant genus *Leptanilloides* (Hymenoptera, Formicidae, Leptanilloidinae). *ZooKeys*, 133: 19–48. [doi:10.3897/zookeys.133.1479](https://doi.org/10.3897/zookeys.133.1479).
12. **Borowiec M.L.**, Schulz A., Alpert G.D., Baňář P. 2011. Discovery of the worker caste and description of two new species of *Anomalomyrma* (Hymenoptera: Formicidae: Leptanillinae) with unique abdominal morphology. *Zootaxa*, 2810: 1–14. [doi:10.11646/zootaxa.2810.1.1](https://doi.org/10.11646/zootaxa.2810.1.1).
11. **Borowiec M.L.** 2011. First record of *Lasius sabularum* (Bondroit, 1918) (Hymenoptera: Formicidae) in Poland. *Myrmecological News*, 14: 137–140. [link](#).
10. **Borowiec M.L.**, Ruta R., Kubisz D. 2010. New records of *Claviger longicornis* Müller, 1818 and *C. testaceus* Preyssl, 1790 (Coleoptera: Staphylinidae: Pselaphinae) in Poland with review of their habits. *Polish Journal of Entomology*, 79: 261–269. [link](#).
9. **Borowiec M.L.** 2009. New data on the occurrence of formicoxenine ants (Hymenoptera: Formicidae) in Poland. *Wiadomości Entomologiczne*, 28: 237–246. [in Polish with English summary] [link](#).
8. **Borowiec M.L.** 2009. New records of the ant *Camponotus truncatus* (Spinola, 1808) (Hymenoptera: Formicidae) in Wrocław and its surroundings. *Wiadomości Entomologiczne*, 28: 200. [in Polish] [link](#).
7. **Borowiec M.L.**, Borowiec L., Csósz S., Radchenko A. 2009. Ants (Hymenoptera: Formicidae) collected during 2006 Polish expedition to Kyrgyzstan. *Genus*, 20: 367–379. [link](#).
6. **Borowiec M.L.** 2009. New ant species related to *Cerapachys sexspinus* and discussion of the status of *Yunodorilus* (Hymenoptera: Formicidae). *Zootaxa*, 2069: 43–58. [doi:10.11646/zootaxa.2069.1.3](https://doi.org/10.11646/zootaxa.2069.1.3).
5. **Borowiec M.L.** 2007. A third species of *Mayriella* from the Oriental Region (Hymenoptera: Formicidae). *Genus*, 18: 773–776. [link](#).
4. **Borowiec M.L.** 2007. A new species of *Tyrannomyrmex* (Hymenoptera: Formicidae: Myrmicinae) from India. *Zootaxa*, 1642: 65–68. [doi:10.11646/zootaxa.3721.3.5](https://doi.org/10.11646/zootaxa.3721.3.5).
3. **Borowiec M.L.** 2007. *Camponotus truncatus* (Spinola, 1808) (Hymenoptera: Formicidae) - ant species new to Poland. *Polish Journal of Entomology*, 76: 41–45. [link](#).
2. **Borowiec M.L.** 2007. Second record of the ant *Leptothorax kutteri* Buschinger, 1966 (Hymenoptera: Formicidae) in Poland. *Przegląd Zoologiczny*, 50: 37–40. [in Polish]
1. Stankiewicz A.M., Sielezniew M., **Borowiec M.L.**, Czechowski W. 2005. *Formica uralensis* Ruzsky (Hymenoptera: Formicidae) in Poland. *Fragmenta Faunistica*, 48: 175–180. [link](#).

## ABSTRACTS AND PRESENTATIONS

24. **Borowiec M.L.**, Zhang Y.M., Neves K., Ramalho M.D.E, Fisher B.L., Lucky A., Moreau C.S. 2021. No one tree to rule them all? Why phylogenomics of large trees may struggle to provide good resolution at all levels. ESA Annual Meeting, Denver, USA. Oral presentation.
23. McKeeken A., **Borowiec M.L.** 2021. Can we automate bug identification? A case study using deep learning to identify photographs of North American arthropods. ESA Annual Meeting, Denver, USA. Poster presentation.
22. **Borowiec M.L.** 2021. Understanding population histories with deep learning. ESA Annual Meeting, Denver, USA. Poster presentation.
21. **Borowiec M.L.**, Lucky A., Ramalho M.D.E, Zhang Y.M., Moreau C.S. 2020. Why are some phylogenetic relationships easy and others hard to resolve? A phylogenomic case study in ants. ESA Annual Meeting, Virtual. Oral presentation.
20. **Borowiec M.L.**. 2019. Clear and unbiased facts about deep learning (without all the hype). Leveraging machine intelligence to study biodiversity. North Carolina State University, Raleigh, USA. Invited talk.
19. **Borowiec M.L.**. 2019. Clear and unbiased facts about deep learning (without all the hype). Leveraging machine intelligence to study biodiversity. Cornell University, Ithaca, USA. Invited talk.
18. **Borowiec M.L.**. 2019. Ant bytes: studying diversity and evolution of ants with the help of modern computing. University of Münster, Münster, Germany. Invited talk.
17. **Borowiec M.L.**. 2018. Ant bytes: studying diversity and evolution of ants with the help of modern computing. University of California, Riverside, USA. Invited talk.
16. **Borowiec M.L.**, Valentini, G., Rabeling C. 2018. A deep learning framework for identification of North American ant genera using photographs of live and preserved specimens. ESA Annual Meeting, Vancouver, Canada. Oral presentation.
15. **Borowiec M.L.** 2018. Ant bytes: studying diversity and evolution of ants with the help of modern computing. Invited talk at University of California, Riverside. Riverside, USA. Oral presentation.
14. **Borowiec M.L.**, Rabeling C. 2018. The early evolution of ants. IUSSI 18th Congress, Guarujá, Brazil. Oral presentation.
13. **Borowiec M.L.**, Rabeling C. 2018. Phylogenomics of *Formica* ants reveals complex speciation patterns and evolution of socially parasitic life histories. IUSSI 18th Congress, Guarujá, Brazil. Oral presentation.
12. **Borowiec M.L.**, Rabeling C. 2017. Phylogenomics of *Formica* ants reveals complex evolution of socially parasitic life histories. ESA Annual Meeting, Denver, USA. Oral presentation.
11. **Borowiec M.L.**, Rabeling C. 2017. Phylogenomics of *Formica* ants reveals complex evolution of socially parasitic life histories. Evolution meeting, Portland, USA. Poster presentation.
10. **Borowiec M.L.** 2016. Resolving Dorylinae: promises and pitfalls of phylogenomics. International Congress of Entomology, Orlando, USA. Oral presentation.
9. **Borowiec M.L.** 2016. AMAS: a fast tool for alignment manipulation and computing of summary statistics. Evolution meeting, Austin, USA. Poster presentation.
8. **Borowiec M.L.** 2016. Phylogenies of rapid radiations can be extremely prone to bias: a cautionary tale from army ants. Evolution meeting, Austin, USA. Oral presentation.
7. **Borowiec M.L.** 2015. Phylogenomics of an ancient rapid radiation: inferring the evolution of doryline ants. ESA Annual Meeting 2015, Minneapolis, USA. Oral presentation.
6. **Borowiec M.L.**, Boudinot B.E., Prebus M.M. 2014. Phylogenetic placement of the ant *Lasius atopus* with implications for the evolution and subgeneric classification of the genus. ESA Annual Meeting 2014, Portland, USA. Poster presentation.
5. **Borowiec M.L.** 2011. Generic revision of dorylomorph ants. ESA Annual Meeting 2011, Reno, USA. Oral presentation.

4. Janda M., **Borowiec M.L.**, Economo, E.P. 2010. The structure of biodiversity in the melanesian ant fauna: scaling up from populations to continents. IUSI 2010, Copenhagen, Denmark. Oral presentation.
3. Janda, M., **Borowiec M.L.** 2009. Where the wild things are: diversity and biogeography of Melanesian ant communities. Central European Workshop of Myrmecology and IUSI 2009, Fraueninsel, Germany. Oral presentation.
2. **Borowiec M.L.**, Janda M. 2007. Regenwälder von Neuguinea - ein Blick auf die Ameisenfauna eines fernen Landes. Internationale Tagung zum Schutz Hügel bauender Waldameisen, 2007, Zittau, Germany. Oral presentation.
1. Janda M., Klimeš P., **Borowiec M.L.** 2007. Ecology of New Guinea ants (Hymenoptera: Formicidae) - exploring an unknown fauna. Central European Workshop of Myrmecology, 2007, Szeged, Hungary. Oral presentation. [Abstract published in: Myrmecological News, 10: 109.]

## GRANTS AND AWARDS

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Over \$900,000 in research funding

### Research grants

USDA-NIFA Food and Agriculture Cyberinformatics and Tools grant, 2020 (PI)	\$499,500
USDA-NIFA Crop Protection and Pest Management Competitive Grants Program grant, 2020 (co-PI)	\$324,470
Jumpstart Grant from <b>University of Idaho</b> , 2019 (PI)	\$19,773
Innovative Postdoctoral Research Grant from <b>ASU School of Life Sciences</b> , 2017	\$2,500
Standard Research Grant from <b>Mazamas Mountaineering Club</b> , 2017	\$975
Microsoft Azure Research Award from <b>Microsoft</b> , 2015	\$20,000
Doctoral Dissertation Improvement Grant from <b>National Science Foundation</b> , 2014	\$19,932
Henry A. Jastro Awards from the Dept. of Entomology, <b>UC Davis</b> , 2011, 2012, and 2013	\$5,900
Young Explorers Grant from <b>National Geographic Society</b> , 2012	\$5,000
SYNTHESYS grant from the <b>Natural History Museum, Paris</b> , 2010	<i>2-week visit to Paris</i>
SYNTHESYS grant from the <b>Natural History Museum, London</b> , 2010	<i>2-week visit to London</i>
Ernst Mayr Travel Grants from <b>Harvard University</b> , 2008, 2009, and 2010	\$2,700

### Awards

- Systematics, Evolution, and Biodiversity Award from the **PBESA**, 2017
- George C. Eickwort Student Research Award from the **IUSI**, 2016
- Scholarship for outstanding academic performance from the **Polish Ministry of Education**, 2008

## COMPUTING SKILLS

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**GitHub page:** [github.com/marekborowiec](https://github.com/marekborowiec)

<b>Languages</b>	Python, R, Bash, SQL, Perl (basics), C++ (basics); L <sup>A</sup> T <sub>E</sub> X, HTML
<b>Software</b>	Variety of tools for sequence processing, alignment, and phylogenetic inference: Sequencher, mafft, muscle, PartitionFinder, RAxML, IQ-TREE, MrBayes, RevBayes, BUCKy, BEAST, ASTRAL, ASTRID, BioGeoBEARS, BAMM, Phyluce pipeline, and other.
<b>Other skills</b>	Adobe Photoshop and Illustrator, standard office suite software. Working on remote computers, version control using Git, containerization with Docker.



## LABORATORY TECHNICAL EXPERTISE

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- DNA extraction and amplification
- RNA isolation
- Next-generation DNA and RNA library preparation
- Target enrichment
- Optical and Scanning Electron Microscopy
- Curation of natural history collections

## RESEARCH EXPERIENCE

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### Tenure Track Research

January 2019 – present

- Phylogenetic and systematic studies of various ant taxa using ultraconserved elements
- Taxonomy of select North American species of *Formica*
- Development of bioinformatic tools for phylogenomics
- Development of machine learning approaches for species identification and molecular species delimitation

### Postdoctoral Research

August 2016 – December 2018

- Used ultraconserved elements for inference of the phylogeny of *Formica* ants
- Supervised development of machine learning tools for automated identification of insects from images

### Doctoral Research

September 2010 – June 2016

- Applied molecular phylogenetic methods to the inference of the evolution of ants and other organisms
- Carried out a monographic treatment of doryline ants, including revision of taxonomy and classification, identification keys, and a review of their biology
- Performed a phylogenomic investigation of doryline ants using ultraconserved elements

### Masters Research

September 2007 – June 2009

- Designed and conducted a taxonomic revision of a Southeast Asian group of ants, including specimen imaging, development of a dichotomous key, and new species descriptions

### Research Assistant/Volunteer

August 2006 – June 2009

*Project: Diversity, biogeography, and ecology of ants of Papua New Guinea*

*PI: Milan Janda*

- Sorting, identification, curation, and databasing of specimens collected in Papua New Guinea

### Research Assistant

May – June 2003

*Project: Role of plumage contrast in foraging of the Painted Redstart*

*PI: Piotr Jabłoński*

- Collected data on behavior and diet of birds at the Southwestern Research Station, Portal, AZ, USA

## ADVISING AND TEACHING EXPERIENCE

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### Instructor

- **Applied Bioinformatics (ENT 504)** University of Idaho, Spring 2020 & 2022  
Command line interface, Python programming, installing and running bioinformatic software, remote computing.
- **General and Applied Entomology (ENT 322)** University of Idaho, each Fall since 2019  
General entomology, including arthropod collecting and identification.
- **Basic Computing for Biologists (ENT 298)** UC Davis, Spring 2015  
Designed the course and taught basics of command line interface, regular expressions, and Python programming.  
[Course materials website](#)

**Teaching Assistant**

- **Introduction to Biology: Biodiversity and the Tree of Life**, UC Davis, 2013 & 2016.  
Taught laboratory section of the class, including introductions to the relevant material and assistance with lab activities. Lower division class.
- **Insect Taxonomy and Field Ecology**, UC Davis, 2012 & 2014.  
Assisted in teaching this intensive field course on morphology, diversity, identification, and ecology of insects. Upper division class.
- **California Insect Diversity**, UC Davis, 2011 & 2015.  
Assisted in teaching field collecting methods, morphology, family-level identification of California insects, and specimen curation techniques; helped update course curriculum. Upper division class.

**Mentor and Advisor**

- **Evolution and systematics of rose gall wasps *Diplolepis* and their inquilines *Periclistus***: one PhD student. University of Idaho, 2021–present.
- **Deep Learning for Automated Identification of Insects**: one undergraduate student transitioning to a masters program under my supervision in 2020. University of Idaho, 2019–present.
- **Population genomics of *Myrmecocystus* ants**: one PhD student. ASU, 2017 & 2018.  
Training a graduate student in lab protocols and phylogenetic analysis of Ultraconserved Elements.
- **Basics of Biological Laboratory Research**: one undergraduate student. ASU, 2017.  
Training and mentoring an undergraduate student in fundamentals of insect specimen curation, databasing, and wet lab work.
- **Machine Learning for Automated Identification of Insect Specimens**: five undergraduate students. ASU, 2017 & 2018.  
Supervising a team of five ASU Software Engineering seniors completing their capstone project.
- **Novel Relationships Between Ants and Plants in Madagascar**: one undergraduate student. Practicum project for Animal Biology major, UC Davis, 2015 & 2016.  
Mentored an undergraduate student throughout his practicum research project. The student is now pursuing a PhD in Evolutionary Biology at ASU.

**PROFESSIONAL DEVELOPMENT**

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**Workshops (research)**

- **Broader Impacts 101: Developing, Implementing and Evaluating BI activities**, U Idaho, November 2019.  
Developing robust broader impacts strategies for NSF grants (half day).
- **Advanced Beginner Python**, UC Davis, April 2016.  
Python modules, code organization, argparse, testing strategies and tools including code coverage, using virtualenv (half day).
- **Ultraconserved Elements (UCEs) as Phylogenomic Markers**, UC Davis, September 2014.  
Genomic DNA library preparation, molecular probe enrichment techniques. and quality control. UCE sequence data analysis (one week).
- **Phylogenetic Analysis Using RevBayes**, NESCent, August 2014.  
Bayesian analysis in a phylogenetic context, using R-like environment of RevBayes. Theory and practice of tree inference, divergence dating, and comparative methods (one week).
- **Online Catalog and Bibliography of Ant Systematics (AntCat) Workshop**, Corte Madera, August 2013.  
A collaborative effort to develop an online, community-based resource for the taxonomy of ants of the world with references (two days).
- **Next-Generation Sequencing for Phylogenetics and Phylogeography**, NESCent, June 2013.  
Handling large data sets obtained using recent sequencing methods, phylogenomics, species tree inference, molecular species delimitation (one week).

- **Software Carpentry**, UC Davis, May 2013.  
Introduction to shell, version control, Python scripting (two days).
- **Bodega Bay Applied Phylogenetics**, UC Davis/Bodega Marine Laboratory, March 2013.  
Theory and practice of a variety of methods in phylogenetic inference, including character evolution, divergence time estimation, correlated trait evolution, and diversification (one week).
- **Symposium and Workshop on New Methods for Phylogenomics and Metagenomics**, UT Austin, February 2013.  
Theory and practice of recently developed methods in phylogenetic inference, focusing on large/phylogenomic data sets (two days).
- **Galaxy Workshop**, UC Berkeley, November 2012.  
Tutorials on the use of Galaxy, a tool-kit for next-generation sequencing data analysis (one day).
- **Workshop to Forward Development of the Hymenoptera Anatomy Ontology**, NCSU, October 2010.  
Contribution to the project of bringing all morphological terminology pertaining to hymenopterous insects under one interactive web portal (five days).
- **Ant Course**, Southwestern Research Station in Portal, AZ, August 2009.  
Practical training in ant systematics, methods of field ecology, identification, and specimen curation (ten days).

#### Workshops (teaching)

- **Series on “Learner-Centered Teaching”**, Center for Excellence in Teaching and Learning, UC Davis, August–September 2013  
A series of weekly workshops on teaching strategies to maximize student learning. Completed with a certificate.

### ACADEMIC SERVICE

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#### Peer-review for the following journals:

*Acta Entomologica Musei Nationalis Pragae, Acta Entomologica Silesiana, Asian Myrmecology, Biodiversity Data Journal, Bulletin of the Society of Systematic Biologists, Ecology, European Journal of Entomology, European Journal of Taxonomy, The Canadian Entomologist, Genus–International Journal of Invertebrate Taxonomy, Insect Systematics and Diversity, Insect Systematics and Evolution, Journal of Biogeography, Journal of the Entomological Research Society, Journal of Hymenoptera Research, Journal of Natural History, Journal of Open Source Software, Journal of Zoological Systematics and Evolutionary Research, Molecular Ecology, Molecular Phylogenetics and Evolution, Myrmecological News, Nature Journal-Opole Scientific Society, North-Western Journal of Zoology, PeerJ, PLoS ONE, Proceedings of the National Academy of Sciences of the USA, Proceedings of the Royal Society B, Przegląd Zoologiczny, Raffles Bulletin of Zoology, Revista Brasileira de Entomologia, Revue Suisse de Zoologie, Science, Sociobiology, Systematic Biology, Systematic Entomology, Wiadomości Entomologiczne, ZooKeys, Zoological Journal of the Linnean Society, Zoologischer Anzeiger, Zootaxa.*

#### Editorial board membership:

*Insect Systematics and Evolution*, Editor-in-Chief since 2022. *Biodiversity Data Journal* 2013–2021 (subject editor for Formicidae, other Hymenoptera), *ZooKeys* 2013–2021 (subject editor for Formicidae), *Polish Journal of Entomology* 2006–2010 (language editor), *Genus* 2006–2015 (language editor).

### PROFESSIONAL SOCIETY AFFILIATIONS

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Entomological Society of America (in presidential line of SysEB section 2022–2026)  
International Society of Hymenopterists  
International Union for the Study of Social Insects  
Society of Systematic Biologists