

Clint Penick PHD

Arizona State University
The Biomimicry Center
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EDUCATION

- 2012 **Ph.D. Biology**
Arizona State University
School of Life Sciences, Tempe, AZ
Advisor: Jürgen Liebig
- 2005 **B.S. Biology**
Florida State University
Department of Biology, Tallahassee, FL
Thesis advisor: Walter Tschinkel

PROFESSIONAL APPOINTMENTS

- 2017 **Assistant Research Professor** (2017-present)
Arizona State University
The Biomimicry Center, Tempe, AZ
- Senior Sustainability Scientist** (2017-present)
Julie Ann Wrigley Global Institute of Sustainability, ASU
- 2013 **Postdoctoral fellow** (2013-2017)
NC State University & NC Museum of Natural Sciences
Department of Applied Ecology, Raleigh, NC
PI: Robert R. Dunn

PUBLICATIONS

- 2018 Beasley DE, **Penick CA**, Boateng NS, Menninger HL, Dunn RR (*accepted*) Urbanization disrupts latitude-size rule in 17-year cicadas. *Ecology and Evolution*.
- 2018 **Penick CA**, Halawani O, Pearson B, Mathews S, López-Urbe MM, Dunn RR, Smith AA (*accepted*) External immunity in ant societies: Sociality and colony size do not predict investment in antimicrobials. *Royal Society Open Science*.
- 2018 Ellison AM, LeRoy CJ, Landesbergen KJ, Bosanquet E, Borden DB, CaraDonna P, Cheney K, Crystal-Ornelas R, DeFreece A, Goralnik L, Irons E, Merkle BG, O'Connell KEB, **Penick CA**, Rustad L, Schulze M, Waser NM, Wysong L (*in press*) Art/Science collaborations: New explorations of ecological systems, values, and their feedbacks. *Bulletin of the Ecological Society of America*.
- 2017 Epps MJ, **Penick CA** Facultative mushroom feeding by common woodland ants (Formicidae, *Aphaenogaster* spp.). *Food Webs*.

- 2017 Gospocic J, Shields E, Glastad KM, Lin Y, **Penick CA**, Yan H, Mikheyev A, Linksvayer T, Garcia BA, Berger S, Liebig J, Reinberg D, Bonasio R. The neuropeptide corazonin controls social behavior and caste identity in ants. *Cell* 170: 748-759.
- 2017 Yan H, Opachaloemphan C, Mancini G, Yang H, Gallitto M, Mlejnek J, Haight K, Ghaninia M, Huo L, Leibholz L, Slone J, Zhou X, Traficante M, **Penick CA**, Dolezal K, Gokhale K, Stevens K, Fetter-Prunedo I, Bonasio R, Zwiebel LJ, Berger S, Liebig J, Reinberg D, Desplan C. An engineered *orco* mutation produces aberrant social behavior and defective neural development in ants. *Cell* 170:736-747.
- 2017 MacClean HJ, **Penick CA**, Dunn RR, Diamond SE. Experimental winter warming increases thermal performance and primes species for spring activity. *Journal of Insect Physiology*. 100:77-81.
- 2017 **Penick CA**, Liebig J. A larval 'princess pheromone' identifies future ant queens based on their juvenile hormone content. *Animal Behaviour* 128:33-40.
- 2017 Diamond SE, Chick L, **Penick CA**, Nichols LM, Cahan SH, Dunn RR, Ellison AM, Sanders NJ, Gotelli NJ. Heat tolerance predicts the importance of species interaction effects as the climate changes. *Integrative and Comparative Biology* 57:112-120.
- 2017 **Penick CA**, Diamond SE, Sanders NJ, Dunn RR. Beyond thermal limits: Comprehensive metrics of performance identify key axes of thermal adaptation in ants. *Functional Ecology* 31: 1091-1100.
- 2017 Cahan SH, Nguyen AD, Stanton-Geddes J, **Penick CA**, Hernáiz-Hernández Y, DeMarco BB, Gotelli NJ. Modulation of the heat shock response is associated with acclimation to novel temperatures but not adaptation to climatic variation in the ants *Aphaenogaster picea* and *A. rudis*. *Comparative Biochemistry & Physiology A* 204:113-120.
- 2016 Diamond SE, Nichols LM, Pelini SL, **Penick CA**, Barber GW, Cahan SH, Dunn RR, Ellison AM, Sanders NJ, Gotelli NJ. Climatic warming destabilizes forest ant communities. *Science Advances* 2:e1600842.
- 2016 Karlik J, Epps MJ, Dunn RR, **Penick CA**. Life inside an acorn: How microclimate and microbes influence nest organization in *Temnothorax* ants. *Ethology* 122:790-797.
- 2016 Brent CS, **Penick CA**, Trobaugh B, Moore D, Liebig J. Induction of a reproductive-specific cuticular hydrocarbon pattern by juvenile hormone in the termite *Zootermopsis nevadensis*. *Chemoecology* 26:195-203.
- 2016 **Penick CA**, Crofton CA, Appler RH, Frank SD, Dunn RR, Tapy DR. The contribution of human foods to honey bee diets in a mid-sized metropolis. *Journal of Urban Ecology* 2:juw001
- 2016 Sasaki T, **Penick CA** [co-first authors], Shaffer Z, Haight KL, Pratt SC, Liebig J. A simple behavioral model predicts the emergence of complex animal hierarchies. *The American Naturalist* 187:765-775.
- 2015 **Penick CA**, Smith AA. The true odor of the odorous house ant. *American Entomologist* 61:85-87.
- 2015 **Penick CA**, Savage AM, Dunn RR. Stable isotopes reveal links between human food inputs and urban ant diets. *Proceedings of the Royal Society B* 282:20142608.
- 2014 **Penick CA**, Brent CS, Dolezal K, Liebig J. Neurohormonal changes associated with ritualized combat and the formation of a reproductive hierarchy in the ant *Harpegnathos saltator*. *Journal of Experimental Biology* 217:1496-1503
- 2014 **Penick CA**, Ebie J, Moore D. A non-destructive method for identifying the sex of ant larvae. *Insectes Sociaux* 61:51-55
- 2013 Diamond SE, **Penick CA**, Pelini SL, Ellison AM, Gotelli NJ, Sanders NJ, Dunn RR. Using physiology to predict the responses of ants to climatic warming. *Integrative and Comparative Biology* 53:965-974 [Faculty of 1000 Prime recommended]

- 2012 **Penick CA**, Prager SS, Liebig J. Juvenile hormone induces queen development in late-stage larvae of the ant *Harpegnathos saltator*. *Journal of Insect Physiology* 58:1643-1649
- 2012 **Penick CA**, Copple RN, Mendez RA, Smith AA. The role of anchor-tipped larval hairs in the organization of ant colonies. *PLOS One* 7: e41595
- 2012 **Penick CA**, Liebig J. Regulation of queen development through worker aggression in a predatory ant. *Behavioral Ecology* 23:992-998
- 2012 **Penick CA**, Trobaugh B, Brent CS, Liebig J. Head-butting as an early indicator of reproductive disinhibition in the termite *Zootermopsis nevadensis*. *Journal of Insect Behavior* 26:23-34
- 2011 **Penick CA**, Liebig J, Brent CS. Reproduction, dominance, and caste: endocrine profiles of queens and workers of the ant *Harpegnathos saltator*. *Journal of Comparative Physiology A* 197:1063-1071
- 2010 Holbrook CT, Clark RM, Moore D, Overson RP, **Penick CA**, Smith AA. Social insects inspire human design. *Biology Letters* 6:431-433 [Top 10 most downloaded article of 2010]
- 2008 **Penick CA**, Tschinkel WR. Thermoregulatory brood transport in the fire ant, *Solenopsis invicta*. *Insectes Sociaux* 55:176-182

GRANTS & AWARDS

- 2017 National Geographic, RFP: Sustainable Cities, *The urban apiary: Evaluating resource use by urban bees using citizen science*, PI **\$150,000** – under review
- 2017 Phi Kappa Phi, *Excellence in Innovation Award*, limited submission–full proposal invited, Co-PI **\$100,000** – under review
- 2016 Mentor for undergraduate research grant, NCSU, awarded to Omar Halawani **\$1,000**
- 2016 Research grant, Triangle Center for Evolutionary Medicine (TriCEM), *Finding the next antibiotics: Putting evolutionary theory into practice*, Co-PI, **\$20,000**
- 2016 Mentor for undergraduate research grant, NCSU, awarded to Omar Halawani and Bria Pearson **\$2,000**
- 2015 Mentor for undergraduate research grant, NCSU, awarded to Jacquelyn Fitzgerald **\$3,000**
- 2014 Mentor for undergraduate research grant, NCSU, awarded to Joseph Karlik **\$1,000**
- 2014 Mentor for undergraduate research grant, NCSU, awarded to Jacquelyn Fitzgerald **\$1,000**
- 2014 Award, YouTube *Your Entomology* award for best science outreach video (*Termite Hunter*, with Adrian Smith & Martin Hoogeboom) from the Entomological Society of America **\$200**
- 2014 W.M. Keck Center for Behavioral Biology competitive travel grant **\$430**
- 2013 George C. Eickwort Student Research Award – recognizes outstanding research by students in the field of social insect biology, awarded by North American Section of the IUSSI **\$1,000**
- 2013 Biomimicry 3.8: Education Summit and Global Conference travel grant **\$400**
- 2013 Best talk, W. M. Keck Center for Behavioral Biology Student/Postdoc Symposium
- 2012 Best poster, session II, North American Chapter of the IUSSI Breakout Meeting, North Carolina
- 2012 North American Chapter of the IUSSI competitive travel grant **\$100**
- 2012 Research Grant, Graduate and Professional Students Association, ASU **\$500**
- 2011 Nominated, Design Excellence Award, Herberger Institute for Design and the Arts, ASU
- 2011 Graduate and Professional Students Association competitive travel grant, ASU, *Seasonal cues and timing of ant queen production* **\$717**
- 2010 Award, Best in show for *Nest cast of the desert harvester ant*, Pogonomyrmex rugosus. Arizona State Fair outreach section
- 2009 NSF conference organization grant, (PI Jennifer Fewell), award #0964277 **\$16,838**

- 2009 Research grant, Graduate and Professional Students Association, ASU, *Neurochemistry of aggression in a social insect* **\$2,000**
- 2009 Research grant, Graduate and Professional Students Association, ASU, *Evolution of nest architecture in desert ants* **\$750**
- 2009 Conference organization grant, Frontiers in Life Sciences workshop, ASU, *Social Biomimicry: Design insights from insect societies*, Co-PI **\$30,000**
- 2009 Training grant, Graduate Initiative Fellowships for Training, ASU **\$1,000**
- 2008 North American Chapter of the IUSSI competitive travel grant **\$250**

INVITED TALKS

- 2017 Symposium speaker (x2), Ecological Society of America meeting, Portland, OR
- 2017 Featured speaker, RTP180 sponsored event, Research Triangle Park, NC
- 2017 Department seminar, The University of North Carolina, Pembroke, NC
- 2017 Humphrey's lecture, Mary Baldwin University, Staunton, VA
- 2017 Department seminar, University of Massachusetts, Dartmouth, MA
- 2017 Department seminar, Rutgers University, Camden, NJ
- 2016 Symposium speaker, International Conference of Entomology (ICE) XXV, Orlando, FL
- 2016 Department seminar, University of the Ryukyus, Okinawa, Japan
- 2016 Featured speaker, Science communication workshop, The Graduate School, NC State University, Raleigh, NC
- 2016 Keynote symposium speaker, Georgia Entomological Society meeting, Pine Mountain, GA
- 2016 Symposium speaker, SE Branch Meeting, Entomological Society of America, Raleigh, NC
- 2016 Department seminar, Entomology, NC State University, Raleigh, NC
- 2016 Department seminar, Research in Progress, Eastern Carolina University, Greenville, NC
- 2015 Featured speaker, Carolina Science Café series, UNC, Chapel Hill, NC
- 2015 Featured speaker, North Carolina Museum of Natural Sciences, Raleigh, NC
- 2015 Featured speaker, Wild West Naturalist Association, Raleigh, NC
- 2015 Symposium speaker, Experimental Biology meeting, Boston, MA
- 2015 Symposium speaker, Entomological Society of America Annual Meeting, Portland, OR
- 2013 Symposium speaker and panelist, Biomimicry 3.8: Education Summit and Global Conference, Boston, MA
- 2011 Featured speaker, Arizona Audubon Society, Phoenix, AZ
- 2011 Symposium speaker, Managing the Hive: Organization of Work in Business and Eusocial Colonies, Tempe, AZ

TEACHING

Instructor

- 2018 Innovation Space (co-instructor), College of Arts and Design, ASU
- 2017 Innovation Space (co-instructor), College of Arts and Design, ASU
- 2017 Bio-inspired Design (co-instructor), Biological Sciences and College of Design, NCSU
- 2016 Travelling Design Studio: Hawaii (visiting instructor), College of Arts and Design, ASU
- 2015 Public Health: From Humans to Social Insects (co-instructor), Biological Sciences, NCSU

- 2012 Bio-inspired Design, College of Arts and Design, ASU
2012 Innovation Space (co-instructor), College of Arts and Design, ASU

Guest lectures

- 2018 Design for Additive Manufacturing, Ira A. Fulton Schools of Engineering, ASU (pending)
2017 Artistic Expression of Original Research, School of Life Sciences, ASU
2017 Advanced Architectural Studio III, The Design School, ASU
2017 Biomimetic Design and the Sonoran Desert, The Design School, ASU
2016 Applied Biogeography, Department of Applied Ecology, NCSU
2013 The Ecology and Evolution of Daily Life, Biological Sciences, NCSU

Teaching Assistant

- 2011 Anatomy and Physiology Lab, Life Sciences, ASU
2010 General Genetics, Life Sciences, ASU
2009 Techniques in Animal Behavior, Life Sciences, ASU
2008 The Living World Lab (Biology for Non-Majors), Life Sciences, ASU
2007 General Biology Lab, Life Sciences, ASU
2006 The Living World Lab (Biology for Non-Majors), Life Sciences, ASU

Student diversity programs

- 2015 Initiative for Maximizing Student Diversity, NCSU (2014-2015)
2009 Graduate Partners in Science Education, ASU (2008-2009)
2006 Upward Bound Program, FSU

Mentorship

Undergraduate students (22, including 14 females and 6 students from underrepresented groups):

Steven Prager, Beth Trobaugh, Neale Copple, Joseph Karlik, Jacquelyn Fitzgerald, Catherine Crofton, Bria Pearson, Omar Halawani, Nikki Knapp, Tiara Butler-Smith, Abdul Matin, Kaetlyn Ryan, Samantha Dietz, Matt Farrell, Chris Williams, Meredith West, Jakini Kauba, Mary Vincent, Natavia Ray, Victoria Figueiredo Paixao, Barbara Birtcil, and Jordan Bednarz.

High school students (3):

Michael Taffe, John Delpapa, and Lowell Hensgen

**Underlined students were co-authors on papers and/or funded grants.*

SCIENCE WRITING & OUTREACH

Popular science writing (selected)

- 2017 "[Strange Worlds in Familiar Places](#)," *Zygote Quarterly* (cover feature)
2017 "[Illustrating Insect Diversity with the New Species Scape](#)," *Verve* postdoc magazine
2016 "[High-fructose Honey and the Diet of Urban Bees](#)," *Oxford University Press* blog
2016 "[The World's Coolest Ants](#)," *North Carolina Naturalist*
2015 "[The Secrets of Insect 'Skin'](#)," *Journal of Investigative Dermatology* blog
2014 "[Fifth Avenue and the Entangled Bank: Fashion in Field Biology](#)," *Your Wild Life* blog
2014 "[The Art and Science of Life After Chernobyl](#)," *Your Wild Life* blog

- 2013 [“The Best Thing About Baby Ants,”](#) *Buzz Hoot Roar* (illustration)
- 2013 [“The Odor of the Odorous House Ant,”](#) *Your Wild Life* blog
- 2013 [“Seeking Intelligence Inside the Swarm,”](#) *Zygote Quarterly*
- 2013 [“Top 10 Ways an Ant’s House is Similar to Your House,”](#) *Your Wild Life* blog
- 2012 [“I, For One, Welcome Our Robot Overlords,”](#) *SOLS* magazine
- 2012 [“Design Studio: Panama,”](#) *SOLS* magazine
- 2011 [“Conservation: The Great Bustards of Mongolia,”](#) *SOLS* magazine (cover feature)
- 2010 [“Amazon’s Small Reserve Reveals Largest Biodiversity on Earth,”](#) *SOLS* magazine

Television and video appearances (selected)

- 2016 [“Ants Fight to Share Dominance,”](#) *Explained by the Author* web series
- 2015 [“Scientists Create Tiny Zones of Climate Change,”](#) National Geographic online
- 2015 [“NC State Researchers Explore Future of Climate Change on Ecosystems,”](#) WRAL
- 2015 [“The Incredible Indian Jumping Ant,”](#) *Strange Truth*, National Geographic Channel
- 2014 [“Ant Battles Offer Insights to Gene Expression,”](#) Reuters online
- 2014 [“The Ant Queen is Dead. Let the Battles Begin,”](#) *ScienceTake*, New York Times

Radio and podcast appearances (selected)

- 2016 [“City Bees Forego Fast Food to Feed on Flowers,”](#) *All Things Considered*, WUNC NPR
- 2016 [“How Do Animals Choose Their Leaders,”](#) *Completely Optional Knowledge* podcast
- 2015 [“This Ant Stinks,”](#) *Science Friday*, NPR
- 2015 [“Pests in the City,”](#) *Science for the People* podcast, NSF Science360
- 2014 [“Ant-agonist Play Game of Thrones,”](#) *Quirks & Quarks*, CBC Radio

Print and online interviews (selected)

- 2017 [“Get Ready for More Mosquitoes and Ants Thanks to Climate Change,”](#) *Vice*
- 2017 [“These Ants Do a Lion King-Like Ritual but With Chemicals,”](#) *Gizmodo*
- 2016 [“How Wild Animals Are Hacking City Life,”](#) *National Geographic*
- 2016 [“City Bees Stick to a Flower Diet Rather Than Slurp Up Soda,”](#) *New York Times*
- 2016 [“Inside an Ant Royal Rumble,”](#) *Discover*
- 2016 [“City Bees Feed On Flowers, Not Junk Food,”](#) *Newsweek*
- 2015 [“Movies and Other Media Inspire Interest in Scientific Concepts,”](#) *Alaska Airlines Magazine*
- 2015 [“NC State Scientists Study the Odor of Ants,”](#) *Raleigh News and Observer*
- 2015 [“NC State Researcher Is Fascinated By Aromas Of Ants,”](#) *Charlotte Observer*
- 2015 [“From Punk Guitarist to Research Entomologist,”](#) *NC State News*
- 2015 [“Ants On New York City’s Streets Survive On Junk Food And Meat,”](#) *Guardian*
- 2015 [“These Urban Ants Love Junk Food As Much As We Do,”](#) *Fast Company*
- 2015 [“The Ants That Smell Like Blue Cheese—Or Is That Pine-Sol?”](#) *WIRED*
- 2015 [“Junk Food is Making NYC Ants More Like Humans,”](#) *LiveScience*
- 2015 [“Our Cheeseburgers Are Changing Ants’ Bodies,”](#) *Mental Floss*
- 2014 [“Ants of New York,”](#) *New Yorker*
- 2014 [“Ants...In...Space,”](#) *NC State News*

Other media coverage

[Associated Press](#), [Daily Mail](#), [EGU Biogeosciences blog](#), [Entomology Today](#), [Food Network Magazine](#), [Food & Wine](#), [Improbable Research](#), [IFL Science](#), [Mitchell News-Journal](#), [Myrmecos](#), [Nature](#), [Nature World News](#), [New York Post](#), [NC State Alumni Magazine](#), [NCSU Technician](#), [Pest Control Technology](#), [Seeker](#), [Science](#), [Science News](#), [TIME](#), [Washington Post](#), [The Wildlife Society](#), KWMU St. Louis Public Radio (NPR affiliate), KCBS San Francisco, 1010 WINS NYC, WFVU Cityscape NY, and WKNC Raleigh.

Outreach and Broader Impacts

- 2018 Organizer, Generous Cities Summit, Tempe, AZ – *A two-day conference and workshop to develop ecological performance standards (EPS) for urban design.* (upcoming)
- 2017 Paid consultant, Biomimicry Kits educational project, Tempe, AZ – *Funded by the Walton Family Foundation to send kits to 50 museums on five continents*
- 2016 Organizer, Warm Forests/Warm Cities breakout meeting, Hunt Library, Raleigh, NC – *30 attendees from 9 institutions*
- 2016 Co-organizer, *The Insects of M.C. Escher*, college night at the North Carolina Museum of Art, Raleigh, NC – *1,600 attendees*
- 2015 Co-organizer, *The physics of ant colonies.* BugFest, North Carolina Museum of Natural History, Raleigh, NC – *35,000 attendees*
- 2015 *Cocktails and Cosmonauts*, hosted and designed outreach table for this event at the Museum of Life and Science, Durham, NC
- 2014 *Ants In Space*, an education project through BioEdOnline and NASA; provided pavement ant colonies that traveled to the International Space Station
- 2014 Co-organizer: *School of Ants* at NSF outreach section, USA Science and Engineering Festival, Washington, DC – *350,000 attendees*
- 2014 Co-organizer, *Social insect biology* Outreach event at BugFest, North Carolina Museum of Natural History, Raleigh, NC – *35,000 attendees*
- 2013 Organizer, *What is that smell?* Outreach project and event on identifying ants by smell at BugFest, North Carolina Museum of Natural History, Raleigh, NC – *40,000 attendees*
- 2010 Co-organizer, Social Insect Science EXPO, community event, Phoenix Desert Botanical Gardens, Phoenix, AZ – *150 attendees*
- 2010 Co-organizer, Social Biomimicry: Insect Societies and Human Design, international conference, Arizona State University, Phoenix, AZ – *80 attendees from 18 institutions*

Reviewer

The American Naturalist, Animal Behaviour, Annals of the Entomological Society of America, Behavioral Ecology and Sociobiology, Biology Letters, BioScience, Conservation Physiology, Current Zoology, Ecological Entomology, Ecology, Ecology Letters, Entomological Science, Environmental Conservation, F1000Research, Global Ecology and Biogeography, Insect Conservation and Diversity, Insectes Sociaux, Insects, Journal of Animal Ecology, Journal of Agricultural Biotechnology and Sustainable Development, Journal of Behavior, Journal of Experimental Biology, Journal of Insect Science, Journal of Thermal Biology, Molecular Ecology, Myrmecological News, Naturwissenschaften–The Science of Nature, Oikos, PLOS ONE.

Book reviewer: University of Chicago Press

Grant reviewer: National Science Foundation (NSF), Graduate & Professional Student Association ASU

Conference presentations

- 2017 Ecological Society of America meeting, Portland, OR
- 2016 International Conference of Entomology (ICE) XXV, Orlando, FL
- 2016 Georgia Entomological Society Meeting, Pine Mountain, GA
- 2016 Southeastern Branch Meeting of the Entomological Society of America, Raleigh, NC
- 2015 Experimental Biology meeting, Boston, MA
- 2015 W.M. Keck Center for Behavioral Biology student/postdoc symposium, Raleigh, NC
- 2014 Entomological Society of America annual meeting, Portland, OR
- 2014 IUSSI XVII International Congress, Cairns, Australia
- 2014 Evolution meeting, Raleigh, NC
- 2014 NC State Postdoc Association research symposium, Raleigh, NC
- 2013 Entomological Society of America annual meeting, Austin, TX
- 2013 Biomimicry 3.8: Education Summit and Global Conference, Boston, MA
- 2013 W.M. Keck Center for Behavioral Biology student/postdoc symposium, Raleigh, NC
- 2012 IUSSI breakout meeting of the North American section, Greensboro, NC
- 2011 Entomological Society of America annual meeting, Reno, NV
- 2011 Animal Behavior Society meeting, Bloomington, IN
- 2010 Entomological Society of America annual meeting, San Diego, CA
- 2010 IUSSI XVI International Congress, Copenhagen, Denmark
- 2010 Social Biomimicry: Insect Societies and Human Design conference, Tempe, AZ
- 2009 Graduates in Earth, Life, and Social Sciences, Tempe, AZ
- 2008 IUSSI breakout meeting of the North American section, Puerto Rico
- 2008 RISE symposium, Tempe, AZ
- 2006 IUSSI XV International Congress, Washington D.C.
- 2005 Entomological Society of America annual meeting, Miami, FL