

# Jonathan Z. Shik

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Assistant Professor

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## EDUCATION

PhD, University of Oklahoma (2010)

B.Sc., McGill University (2003)

## APPOINTMENTS

2018-present Assistant Professor, Centre for Social Evolution, University of Copenhagen  
 2016-2018 Postdoctoral Researcher, Centre for Social Evolution, University of Copenhagen  
 2014-2016 Marie Curie Postdoctoral Fellow, Centre for Social Evolution, University of Copenhagen,  
 advisor: Jacobus Boomsma  
 2013-2014 Postdoctoral Fellow, Smithsonian Tropical Research Institute, advisor: Bill Wcislo  
 2011-2013 Postdoctoral Research Associate, Department of Entomology, North Carolina State  
 University, advisor: Jules Silverman  
 2010 Research Associate, University of Oklahoma, based at Smithsonian Tropical Research  
 Institute, Panama  
 2009 Research Fellow: Alumni Fellowship, University of Oklahoma

## EDITORIAL POSITIONS

Planned 2019 Journal of Animal Ecology

## GRANTS AND AWARDS (TOTAL EXTERNAL FUNDING 2005 – 2018: (€ 1,846,470; \$ 2,104,975)

2017 European Research Council Starting Grant (ERC StG), €1.5 million (\$1,710,000)  
 Finalist, for CNRS position at Pierre and Marie Curie University (Paris)  
 2014 BIO Incentive grant to support international PhD course (Faculty of Science, U.  
 2013 Copenhagen – together with Rachelle Adams and Koos Boomsma), €9,000 (\$10,260)  
 EU Marie Curie International Incoming Postdoctoral Fellowship, €240,000 (\$273,600)  
 2012 Smithsonian Tropical Research Institute, Postdoctoral Fellowship, €55,000 (\$62,700)  
 2011 Association for Biology Lab Instructors Conference, Major Workshop, €170 (\$194)  
 National Inst. for Mathematical and Biological Synthesis, short term research grant:  
 €1700 (\$1,938)  
 2004-2010 Alumni Fellowship from the Graduate College at the University of Oklahoma: €22,000  
 (\$25,080)  
 Graduate Research Supplemental Stipend, U. Oklahoma, Dept. Zoology: €2,200  
 (\$2,500)  
 2009 University of Oklahoma Biostation, summer research grant: €2,200 (\$2,500)  
 2008 NSF teaching grant to redesign introductory zoology: €1,400 (\$1,596)  
 Adams Summer Research Fellowship: €2,200 (\$2,500)

	Gordon Research Conference on the Metabolic Basis of Ecology: Competitive stipend for delivering invited seminar: €1,400 (\$1,596)
2007	Graduate Student Senate Research Stipend: €400 (\$456) Adams Summer Research Fellowship: €2,200 (\$2,500)
2006	Adams Summer Research Fellowship: €2,200 (\$2,500)
2005	Adams Summer Research Fellowship: €2,200 (\$2,500) Smithsonian Tropical Research Institute, Short Term Fellowship: €2,200 (\$2,500)

## TEACHING

### Graduate-level teaching:

Advanced Ecology (assistant coordinator)	Fall 2018
Evolutionary Ecology (assistant coordinator)	Fall 2018
Macroecology (lecturer)	Fall 2017, 2018
Invasion Biology (lecturer)	Spring 2018

### Graduate-level course organizer:

Tropical Behavioural Ecology and Evolution, field course at the Smithsonian Tropical Research Institute (Co-organizer with Rachelle Adams, instructor from Ohio State University)	April - May 2011 April - May 2013 April - May 2015 April - May 2017
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### Undergraduate courses:

Concepts in Biology (non-majors)	Spring 2010 Fall 2008 Spring 2007
Introductory Zoology	Fall 2007 Spring 2006
Principles in Ecology	Fall 2006 Spring 2005 Fall 2005

## SUPERVISING

### *PREVIOUS GRADUATE & UNDERGRADUATE STUDENTS*

2018	Maria Scotwin: Bachelors thesis, " <i>The nutritional ecology of crop domestication in fungus farming ants</i> " (U. Copenhagen)
2018	Mads Wolter Nielsen: Masters thesis, "Nutrient flow in <i>Acromyrmex</i> colonies" (co-supervised) (U. Copenhagen)
2017	Birla Krabbe: Bachelors thesis, " <i>Defining an ant's nutritional niche in three dimensions</i> ", (co-supervised) (U. Copenhagen)
2017	Christoffer Bergstedt: Bachelors thesis, " <i>The nutritional ecology of invasive <i>Monomorium ants</i></i> ", (co-supervised) (U. Copenhagen)
2017	Winnie Rytter: Masters thesis, " <i>Fungus-farming ant nutritional ecology</i> ", (co-supervised) (U. Copenhagen)
2014	Angelo Concilio: Masters student, University of Turino, Smithsonian Tropical Inst. Mariana Franco: Research Intern at the Smithsonian Tropical Research Institute
2013	Ernesto Gomez: Research Intern at the Smithsonian Tropical Research Institute

- 2012 Matt Green and Shanna Wood: Undergraduate field assistants, North Carolina State University.
- 2010 Deana Flatt: NSF REU undergraduate, at Smithsonian Tropical Research Institute
- 2004-2009 Undergraduate Research Assistants in the Kaspari lab at the University of Oklahoma: Shelly Sudberry, Matt Dowling, Julie Miller, Risa Walters, Deanna Flatt

#### *CURRENT GRADUATE STUDENTS*

- 2019 (exp) Calum Stephenson: Masters thesis, "chemical communication between ants and their fungal cultivars"
- 2019 (exp) Zsuzsanna Csontos: Masters thesis, "*The nutritional basis of host specificity in insect pathogens*" (co-supervised)
- 2019 (exp) Pol Lannes Salvado: *Physiological ecology of fungus-farming ants.*

#### *CURRENT POSTDOCTORAL STUDENTS*

- 2018- Antonin Crumiere

#### *INTERNATIONAL STUDENTS HOSTED IN MY LAB*

- 2018-2019 Hugo Merienne: PhD student from Research Center on Animal Cognition in the university Paul Sabatier (Toulouse, France), insect metabolic physiology (collaboration with Dr. Vincent Fourcassie)
- 2017 Cristele Sanchez Oms: PhD student from the University of Tours (France), insect metabolic physiology (collaboration with Dr. Xim Cerda and Dr. Raphael Boulay)
- 2016 Pol Lannes Salvado: ERASMUS bachelors student from the University of Barcelona (Spain), insect nutritional ecology (collaboration with Dr. Jes Pedersen)

#### INVITED SEMINARS

- 2018 Lund University, Departmental Seminar, Lund, Sweden  
Smithsonian Tropical Research Institute, Tupper Seminar, Panama  
Centre for Macroecology, Evolution and Climate, University of Copenhagen, Denmark  
Symposium: Latest frontiers in the nutritional ecology of social insects, Entomological Society of America, Vancouver, Canada
- 2017 North Carolina State, Raleigh, USA  
University of Illinois at Urbana-Champaign, USA  
California State University, Fresno, USA  
Hebrew University of Jerusalem, Israel
- 2016 University of Pierre and Marie Curie, Paris, France  
University of Regensburg, Regensburg, Germany  
Symposium: Physiological responses to environmental change, International Congress for Entomology, Orlando, Florida, USA  
Michigan State University, USA  
University of Scranton, Pennsylvania, USA  
Jodrell Laboratory, Royal Botanic Gardens, Kew, London
- 2015 Smithsonian Tropical Research Institute, Panama City, Panama  
Institute of Science and Technology, Vienna, Austria  
Centre for Social Evolution, University of Copenhagen, Denmark  
Centre for Macroecology, Evolution and Climate, University of Copenhagen, Denmark  
University of Oklahoma, Norman, USA  
Universite Paul Sabatier, Toulouse, France  
University of Pierre and Marie Curie, Paris, France

- 2014 Symposium: Nutrition: Behavior and Life History, International Society for Behavioral Ecology, New York
- 2013 Smithsonian Tropical Research Institute: Tupper Talk, Panama  
University of Oklahoma, Norman, Oklahoma  
University of Costa Rica, San Jose: Departmental Seminar
- 2012 Symposium: Social Insects and the emergence of novelty: from local rules to global behaviour. Entomological Society of America, Knoxville, Tennessee  
Gordon Conference Metabolic Ecology, Biddeford, Maine
- 2011 National Evolutionary Synthesis Center, Durham, North Carolina  
North Carolina State University, Department of Entomology  
Eastern Tennessee State University, Department of Biology  
University of Tennessee, Department of Ecology and Evolutionary Biology
- 2010 Smithsonian Tropical Research Institute: Behavior Discussion Group  
Smithsonian Tropical Research Institute: Bambi Seminar on BCI  
University of Oklahoma, Zoology Department Seminar
- 2009 Kansas State University, Seminars in Ecology and Evolutionary Biology  
Departmental retreat of Zoology, Lake Texoma, The University of Oklahoma
- 2008 Gordon Research Seminar: Metabolic Basis of Ecology, Biddeford, Maine. 2008.  
Ecomunch Seminar, Graduate Program in Ecology and Evolutionary Biology, University of Oklahoma
- 2007 Smithsonian Tropical Research Institute: Bambi Seminar on BCI

### SPECIALIZED WORKSHOPS

- 2019 University of Copenhagen Forward Talent Programme for Excellence in Research  
Pedagogy Course, University of Copenhagen
- 2017 DNA barcoding summit, diversity in a Panamanian fungus growing ant community, University of Copenhagen
- 2008, 2013 Respirometry Course, Sable Systems International, Las Vegas, NV
- 2006 Soil Acarology Course, The Ohio State University Acarology Laboratory, Columbus, OH
- 2005 The Ant Course, California Academy of Sciences & Harvard University Museum of Comparative Zoology, Portal, AZ

### ACADEMIC SERVICE

*Reviewer: Peer-Reviewed Journals (average 14 reviews per year)*

Acta Ethologica, Agricultural and Forest Entomology, Animal Behaviour, Arthropod-Plant Interactions, Behavioral Ecology and Sociobiology, Biological Invasions, Biological Journal of the Linnean Society, Biology Letters, Current Zoology, Ecography, Ecological Entomology, Ecology, Ecology and Evolution, Ecology Letters, Ecosystems, Entomologia Experimentalis et Applicata, Environmental Entomology, European Journal of Entomology, Evolution, Evolutionary Biology, Functional Ecology, Global Change Biology, Insect Conservation and Diversity, Insects, Insectes Sociaux, Journal of Animal Ecology, Journal of Applied Entomology, Journal of Asia-Pacific Entomology, Journal of Insect Behavior, Journal of Insect Physiology, Journal of Insect Science, Myrmecological News, Naturwissenschaften, Oecologia, Oikos, PeerJ, PLoS One, Proceedings of the Royal Society B, Rangeland Ecology and Management, Revista Brasileira de Entomologia, Scientific Reports

Reviewer: Grant Agencies

European Research Council (ERC), National Science Foundation (USA), Sapere Aude (Denmark), US-Israel Binational Agricultural Research and Development Fund (BARD: US-Israel), Binational Science Foundation (BSF: US-Israel), Austrian Science Fund

Grant Review Panels

Fundação para a Ciência e a Tecnologia, I. P. (FCT) (Reviewed 25 proposals (15 as lead reviewer) for the Central Portuguese Funding Agency, April 2018)

Current Professional Affiliations

International Union for the Study of Social Insects

Symposium Organizer

2020            Insect eco-physiology, International Congress for Entomology (every 4<sup>th</sup> year),  
planned        Helsinki, Finland, (Co-organized)  
2018            Social insect eco-physiology across scales, International Union for the Study of Social  
                    Insects (every 4<sup>th</sup> year), Guarujá, Brazil (co-organized)  
2016            Physiological responses to environmental change, International Congress for  
                    Entomology (every 4<sup>th</sup> year), Orlando, Florida, USA (Co-organized)

UNIVERSITY SERVICEAcademic committees & service

2018            Panelist and speaker in ERC Starting Grant Information Meeting at KU  
2017-2018      Section of Ecology and Evolution weekly seminar organizer  
                    BIO-Conference organizing committee  
2009            Zoology representative in the graduate student senate  
2008            Graduate student Zoology Department faculty representative  
2007            Graduate student representative on Zoology Department admissions committee

Public outreach

2014-2017      Culture Night, organized the social insect booth, Copenhagen, Denmark  
2016            Consulted with the Copenhagen Zoo on a new exhibit on ecology and  
                    evolutionary biology and a new leafcutter ant husbandry project  
2015            Collaborated with Dr. Jacobus Boomsma, Dr. Christian Peeters, and artist Naret  
                    Phansua on educational cartoon titled 'The fungus growing ants: from simple  
                    gardening to industrial farming'. This movie is being shown in natural history  
                    museums in France and is planned to be used in Denmark as well.  
2012            Talk at high school: The North Carolina School of Science and Mathematics, 'The  
                    Social Insects'  
2010            Panel on 'Careers in the Biological Sciences', Graduate student representative,  
                    The University of Oklahoma  
                    Darwin Day lecture for the lay public, 'The evolution of eusociality', The University  
                    of Oklahoma

In the Media

-Substantial coverage in September 2017 for my ERC Starting Grant by the Danish press  
(<http://magisterbladet.dk/news/2017/september/myrererdygtigelandmaend>)  
-My 2016 PNAS paper had an Almetric score of 98, ranked in the 97<sup>th</sup> percentile of tracked  
articles of similar age in all journals, having been covered by several major news outlets  
(<http://www.pnas.org/content/113/36/10121.full?tab=metrics>)

- <http://riaus.tv/blogs/do-ant-farmers-forage-their-%E2%80%98lunchbox%E2%80%99>  
(Australia's Science Channel)
- Smithsonian Institution Newsletter: 'How much energy is needed to farm fungus?'  
([http://www.jonathanshik.com/uploads/2/6/2/9/26297749/strinews\\_aug\\_22\\_2014.pdf](http://www.jonathanshik.com/uploads/2/6/2/9/26297749/strinews_aug_22_2014.pdf))
- ScienceDaily.com: 'Research predicts growth, survival of 'superorganism' ant colonies'  
(<http://www.sciencedaily.com/releases/2012/12/121219092819.htm>)
- Association for Biology Laboratory Education  
(<http://www.ableweb.org/conf/able2012/photopub/index2.html>)

### PUBLICATIONS, PRESENTATIONS, AND MANUSCRIPTS [IMPACT FACTOR]

H-INDEX = 11, I10-INDEX = 15; TOTAL CITATIONS = 272 (GOOGLE SCHOLAR)

\* = graduate student; \*\* = undergraduate student

26. Kooij PW, Dentiger BM, Donoso D, Shik JZ, Gaya, E. (*In Press*) Cryptic diversity in Colombian edible ants, *Atta* spp. Fabricius, 1804 [Hymenoptera: Formicidae: Attini]. ***Insects***, X:X-X. [1.848]
25. Sapountzis P, Zhukova M, Shik JZ, Schiøtt M, Boomsma JJ (2018) Reconstructing the symbiotic functions of intestinal Mollicutes in fungus-growing ants. ***eLife***, 7:e39209. [7.725]
24. Hamilton N\*, Jones, TH, Shik JZ, Wall B\*, Schultz TR, Blair HA\*\*, Adams RMM (2018) Context is everything: Mapping Cyphomyrmex-derived compounds to the fungus-growing ant phylogeny. ***Chemoecology***, 28:137-144. [1.642]
23. Rodrigues da Costa R\*, Vreeburg SME\*, Shik JZ, Aanen DK, Poulsen M (2018) Can interaction specificity in the fungus-farming termite symbiosis be explained by nutritional requirements of the crop fungi? ***Fungal Ecology***, X:X-X. [3.10]
22. Shik JZ, Rytter W\*, Arnan X, Michelsen A (2018) Disentangling nutritional pathways linking leafcutter ants and their co-evolved fungal symbionts using stable isotopes. ***Ecology***, 99:1999-2009. [5.175]
21. Shik JZ, Consilio A\*, Kaae T\*, Adams RMM (2018), Farming ants nutritionally manage fungal mutualists and social parasites. ***Ecological Entomology***, 43:440-446. [1.687]
20. Shik JZ, Gomez EB\*\*, Kooij PW\*, Santos JC, Wcislo WT, Boomsma JJ (2016) Nutrition mediates the expression of cultivar-farmer conflict in a fungus-growing ant. ***Proceedings of the National Academy of Sciences, USA***, 113:10121-10126. [9.423]
19. Guenard B, Shik JZ, Booher D\*, Lubertazzi D\*, Alpert G (2016) Extreme polygyny in the previously unstudied subtropical ant *Temnothorax tuscaloosae* (Hymenoptera: Formicidae), with implications for the biogeographic study of the evolution of polygyny. ***Insectes Sociaux***, doi: 10.1007/s00040-016-0498-7. [1.267]
18. Rytter W\*, Shik JZ (2016) Liquid foraging behavior in leafcutting ants: The lunchbox hypothesis. ***Animal Behaviour***, 117:179-186. [3.068]
17. Shik JZ, Schal C, Silverman J (2014) Diet specialization in an extreme omnivore: nutritional regulation in glucose averse cockroaches. ***Journal of Evolutionary Biology***, 27:2096-2105. [3.483]
16. Shik JZ, Kay A, Silverman J (2014) Aphid honeydew provides a nutritionally balanced resource for incipient Argentine ant mutualists. ***Animal Behaviour***, 95:33-39. [3.068]

15. Shik JZ, Santos JC, Seal JN, Kay A, Mueller UG, Kaspari M (2014) Metabolism and the rise of fungus cultivation by ants. **American Naturalist**, 184:364-373. [4.725]
14. Shik J.Z., Donoso DD, Kaspari M (2013) The life history continuum hypothesis links traits of male ants with life outside the nest. **Entomologia Experimentalis et Applicata**, 149:99-109. [1.442; *invited review*]
13. Bednar D\*, Shik JZ, Silverman J (2013) Prey handling performance facilitates behavioral dominance of an invasive over a native keystone ant. **Behavioral Ecology**, 24:1312-1319. [3.083]
12. Shik JZ, Silverman J (2013) Towards a nutritional ecology of invasive establishment: aphid mutualists provide better fuel for incipient Argentine ant colonies than insect prey. **Biological Invasions**, 15:829-836. [2.855]
11. Shik JZ, Flatt, D\*\*, Kay AD, Kaspari M (2012) A life history continuum in the males of a Neotropical ant assemblage: refuting the sperm vessel hypothesis. **Naturwissenschaften**, 99: 191-197. [2.098]
10. Shik JZ, Hou C, Kay A, Kaspari M, Gillooly JF (2012) Toward a general life history model of the superorganism: predicting the survival, growth, and reproduction of ant societies. **Biology Letters**, 8:1059-1062. [2.823]
9. Spicer Rice E\*, Shik JZ, Silverman J (2012) Effect of scattered and discrete hydramethylnon bait placement on the Asian needle ant, *Pachycondyla chinensis* Emery. **Economic Entomology**, 105:1751-1757. [1.609]
8. Kay AD, Shik JZ, Van Alst A\*\*, Kaspari M (2012) Diet composition does not affect ant colony tempo. **Functional Ecology**, 26:317-323. [5.21]
7. Shik JZ, Kaspari M, Yanoviak S (2011) Preliminary assessment of metabolic costs of the nematode *Myrmeconema neotropicum* on its host, the tropical ant *Cephalotes atratus*. **Journal of Parasitology**, 97:958-959. [1.394]
6. Shik JZ (2010) The metabolic costs of building ant colonies from variably sized subunits. **Behavioral Ecology and Sociobiology**, 64:1981-1990. [2.565]
5. Kaspari M, Stevenson B, Shik JZ, Kerekes J\* (2010) Scaling biodiversity: how bacteria, fungi, and ant communities respond to the same tropical landscape. **Ecology**, 91:2221-2226. [5.175]
4. Shik JZ, Kaspari M (2010) More food, less habitat: how necromass and leaf litter decomposition combine to regulate a litter ant community. **Ecological Entomology**, 35:158-165. [1.687]
3. Shik JZ, Kaspari, M. (2009) Male lifespan in ants linked to mating systems. **Insectes Sociaux**, 52:131-134. [1.267]
2. Shik JZ (2008) Ant colony size and the scaling of reproductive effort. **Functional Ecology**, 22:674-681. [5.21]
1. Shik JZ, Francoeur A, Buddle CM (2005) The effect of human activity on ant species (Hymenoptera: Formicidae) richness at the Mont St. Hilaire Biosphere Reserve, Quebec. **The Canadian Field Naturalist**, 118:38-42.

Other Publications in Refereed Journals:

- Shik JZ, Nichols LM, Lucky A, Hoefnagels MH (2013) Ants as model organisms to study species coexistence. *Proceedings of the 34<sup>th</sup> Workshop Conference of the Association for Biology Laboratory Education*, 34:233-239.

**In Review**

Shik JZ, Arnan X, Oms CS\*, Cerda X, Boulay R (*In Revision, Journal of Animal Ecology*)  
Evidence for locally adaptive metabolic temperature sensitivity with elevation in the ant  
*Aphaenogaster iberica*.

Krabbe BA\*, Arnan X, Lannes P\*, Echtvad Bergstedt, C\*, Stenbak Larsen R\*\*, Pedersen JS, Shik  
JZ (*In Review, Functional Ecology*) Nutritional dimensions of invasive success: defining  
the fundamental macronutrient niche of a widespread invasive ant.

**In Preparation**

Shik JZ, Kooij PW, Donoso D, Gomez EB\*\*, Franco M\*\*, Santos JC, Wcislo WT, Boomsma JJ  
Cryptically diverse cultivars provide diverse performance benefits for fungus-farming  
ants.

Bill, B.E.\*, Kaspari, M.E., Shik, J.Z., Wright, S.J., Stevenson, B.S. The effect of long term NPK  
fertilization on bacterial communities in leaf litter from a lowland tropical rainforest.

**PRESENTATIONS FOR PROFESSIONAL MEETINGS**

- Shik, J.Z. (2018) Nutritional dimensions in insect-fungus co-evolution. Mini Symposium: Fungal ecology and evolution. Section for Ecology and Evolution, University of Copenhagen.
- Pedersen J.S., Krabbe, B.A., Shik, J.Z. (2018) Pharaoh ant workers regulate nutrition to prioritize colony growth over individual survival. International Union for the Study of Social Insects. Brazil.
- Shik, J.Z., Oms, C.S., Arnan, X., Cerda, X., Boulay, R. (2018) Metabolic temperature sensitivity in ants. International Union for the Study of Social Insects. Brazil.
- Oberweiser M, Beres Z, Shik J.Z., Adams, R.M.M. (2017) Unraveling a Panamanian caterpillar/ant mutualism. Ohio State University Student Research Symposium, 2017.
- Mularo, A.J., Shik, J.Z., Adams, R.M.M. (2017) Dynamics of pseudoscorpions in a neotropical rainforest. Ohio State University Student Research Symposium, 2017.
- Kooij, P.W., Gaya, E., Shik, J.Z., Dentinger, B.T.M. On the origin of mutualisms: where did fungus farming in ants begin? European Society of Evolutionary Biology, Groningen, The Netherlands, 2017.
- Kooij, P.W., Gaya, E., Shik, J.Z., Dentinger, B.T.M. On the origin of mutualisms. 8th Brazilian Congress for Mycology, Florianopolis, Brazil, 2016.
- Shik, J.Z., Wcislo, W. T., Boomsma, J.J. Nutrition mediates the expression of cultivar-farmer conflict in a fungus-growing ant. IUSSI Europe, Helsinki, Finland, 2016.
- Rytter, W., Michelsen, A., Shik, J.Z. Tracing the flow of nutrients through the complex symbiotic network of the leafcutter ant *Atta colombica* using stable isotopes. IUSSI Europe, Helsinki, Finland, 2016.
- Rytter, W., Shik, J.Z. The leafcutter lunchbox: linking digestive physiology and foraging behavior of four Panamanian leafcutter ant species. Oikos, Turku, Finland, 2016
- Shik, J.Z., Wcislo, W. T., Boomsma, J.J. Transitions in farming performance across the attine phylogeny. Oikos, Turku, Finland, 2016.
- Shik, J.Z., Wcislo, W. T., Boomsma, J.J. Physiological consequences of social transitions in ants. International Congress of Entomology, Orlando, Florida, 2016.
- Shik, J.Z., Gomez, E., Wcislo, W.T., Boomsma, J.J. Nutrition mediates cultivar-farmer conflict in a primitive fungus-growing ant. European Society for Evolutionary Biology, Lausanne, 2015.
- Wall, B.M., Jones, T.H., Shik, J.Z., Adams, R.M.M. Evolution of alarm signals: a comparative study of exocrine gland chemistry in attine ants with a special focus on alarm pheromones. International Society of Chemical Ecology, Stockholm, 2015.
- Shik, J.Z. Nutritional adaptations in the cultivars grown by fungus-growing ants. Plant-Insect-Microbe Interactions Symposium. University of Copenhagen, Denmark, 2015.
- Kooij, P.W., Shik, J.Z., Gomez, E., Wcislo, W., Boomsma, J.J. Fast—growing fungal crops grown



- by the ant *Trachymyrmex cornetzi* appear more resistant the fungal pathogen *Escovopsis*. Northwest European Society for the Study of Social Insects, London, 2014.
- Shik, J.Z. Physiological transitions in farming ants. In the symposium: Nutrition: Behavior and Life History, International Society for Behavioral Ecology, New York, 2014.
- Shik, J.Z., Gomez, E., Santos, J.C., Kaspari, M., Boomsma, J.J., Wcislo, W.T. Physiology and the transition from hunting to farming in ants. International Union for the Study of Social Insects, Cairnes, Australia, 2014.
- Shik, J.Z. The evolutionary ecology of fungus growing ants. Smithsonian Fellows Symposium, Panama City, Panama, 2014.
- Shik, J.Z. Linking the traits of male ants with the ecological demands of diverse mating systems. Association of Tropical Biology and Conservation, San Jose, Costa Rica, 2013.
- Silverman, J., Shik, J.Z., Schal, C. Nutrient regulation and post-ingestive utilization in glucose averse German cockroaches. Entomological Society of America, Knoxville, TN, 2012.
- Shik, J.Z. Toward a general life history model of the superorganism. In the symposium: Social Insects and the emergence of novelty: from local rules to global behaviour. Entomological Society of America, Knoxville, TN, 2012.
- Shik, J.Z., Kay, A.D., Silverman, J. Energy subsidies from aphid mutualists fuel invasive establishment by Argentine ants. Ecological Society of America, Portland, OR. 2012.
- Shik, J.Z. Towards a comparative physiology of insect societies. The Gordon Research Conference: Metabolic Basis of Ecology, Biddeford, ME, 2012.
- Kay, A.D., Shik, J.Z., Van Alst, A., Miller, K.A., Kaspari, M. Diet composition does not affect ant colony tempo. Entomological Society of America, Reno, NV. 2011.
- Shik, J.Z. Using metabolic scaling to examine how ant colonies work: the case of *Pheidole* majors. IUSI Congress: The International Union for the Study of Social Insects, Copenhagen, Denmark 2010.
- Shik, J.Z. Metabolic scaling links the traits of individual ants to their colonies. Ecological Society of America, Albuquerque, NM. 2009.
- Shik, J.Z. Ant colony size and the scaling of reproductive effort. Ecological Society of America, Milwaukee, WI. 2008.
- Shik, J.Z. The metabolic implications of ant colony size. Gordon Research Seminar: Metabolic Basis of Ecology, Biddeford, ME. 2008.