

Jonathan Z. Shik

Marie Curie Postdoctoral Fellow

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EDUCATION

- 2004-2010 Ph. D., University of Oklahoma, Graduate Program in Ecology and Evolutionary Biology
Advisor: Dr. Michael Kaspari
Dissertation: The ecological importance of ant colony size
- 2001-2003 B.Sc., McGill University, Biology
Advisor: Dr. Martin Lechowicz
Thesis: The effects of human activity on the ants of a biosphere reserve
- 1999-2001 Cornell College (*transferred to McGill*)
Advisor: Dr. Marty Condon

PROFESSIONAL APPOINTMENTS

- 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, NSF research: The stoichiometry of brown food webs, advisors: Michael
Kaspari and Adam Kay
- 2009 Research Fellow: Alumni Fellowship, University of Oklahoma

PUBLICATIONS, PRESENTATIONS, AND MANUSCRIPTS

Publications Accepted to Refereed Journals:

20. Shik, J.Z., Gomez E.B., Kooij P.W., Santos, J.C., Wcislo W.T., Boomsma, J.J. (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.
19. Guenard, B.*, Shik, J.Z.*, Boher, 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.
*Authors contributed equally to the study
18. Rytter, W.[^], Shik, J.Z. (2016) Liquid foraging behavior in leafcutting ants: The lunchbox hypothesis. *Animal Behaviour*, 117:179-186.
[^]Supervised masters student
17. Shik, J.Z., Schal C., Silverman, J. (2014) Diet specialization in an extreme omnivore: nutritional regulation in glucose averse cockroaches. *Journal of Evolutionary Biology*, 27:2096-2105.
16. Shik, J.Z., Kay, A., Silverman J (2014) Aphid honeydew provides a nutritionally balanced resource for incipient Argentine ant mutualists. *Animal Behaviour*, 95:33-39.
15. Shik, J.Z., Santos, J.C., Seal, J.N., Kay A., Mueller, U.G., Kaspari, M. (2014) Metabolism and the rise of fungus cultivation by ants. *American Naturalist*, 184:364-373.

14. *Shik, J.Z., Donoso, D.D., 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.
* invited review paper
13. Bednar, D., Shik, J.Z., Silverman, J. (2013) Prey handling performance facilitates behavioral dominance of an invasive over a native keystone ant. *Behavioral Ecology*, 24:1312-1319.
12. Shik, J.Z., 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.
11. Shik, J.Z., Flatt, D.^Δ, Kay, A.D., Kaspari, M. (2012) A life history continuum in the males of a Neotropical ant assemblage: refuting the sperm vessel hypothesis. *Naturwissenschaften*, 99: 191-197.
^Δ mentored undergraduate
10. Shik, J.Z., Hou, C., Kay, A., Kaspari, M., Gillooly, J.F. (2012) Toward a general life history model of the superorganism: predicting the survival, growth, and reproduction of ant societies. *Biology Letters*, 8:1059-1062.
9. Spicer Rice, E., Shik, J.Z., Silverman, J. (2012) Effect of scattered and discrete hydramethylnon bait placement on the Asian needle ant, *Pachycondyla chinensis* Emery. *Economic Entomology*, 105:1751-1757.
8. Kay, A.D., Shik, J.Z., Van Alst, A., Kaspari, M. (2012) Diet composition does not affect ant colony tempo. *Functional Ecology*, 26:317-323.
7. Shik, J.Z., 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.
6. Shik, J.Z. (2010) The metabolic costs of building ant colonies from variably sized subunits. *Behavioral Ecology and Sociobiology*, 64: 1981-1990.
5. Kaspari, M., Stevenson, B., Shik, J.Z., Kerekes, J. (2010) Scaling biodiversity: how bacteria, fungi, and ant communities respond to the same tropical landscape. *Ecology*, 91:2221-2226.
4. Shik, J.Z., 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.
3. Shik, J.Z., Kaspari, M. (2009) Male lifespan in ants linked to mating systems. *Insectes Sociaux*, 52: 131-134.
2. Shik, J.Z. (2008) Ant colony size and the scaling of reproductive effort. *Functional Ecology*, 22: 674-681.
1. Shik, J.Z., Francoeur, A., Buddle, C.M. (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.

Manuscripts in Review:

- Shik, J.Z., Gomez, E.B., Wcislo, W.T., Boomsma, J. J. (*Biology Letters*) Symbiotic performance before and after irreversible crop domestication by fungus-farming ants.
- Shik, J.Z., Consilio, A.^Δ, Kaae, T.^Δ, Adams, R.M.M. (*Oecologia*) Farming ants nutritionally manage fungal mutualists and social parasites.

^ΔSupervised masters students

Other Publications in Refereed Journals:

Shik, J.Z., Nichols, L.M., Lucky, A., Hoefnagels, M.H. (2013) Ants as model organisms to study species coexistence. *Proceedings of the 34th Workshop Conference of the Association for Biology Laboratory Education*, 34:233-239.

Bisel, R., Shik, J.Z. (2009) Book Review: The Superorganism. *Organizational Studies*

Manuscripts In Preparation:

Shik, J.Z., Gomez E.B., Kooij P.W., Santos, J.C., Wcislo W.T., Boomsma, J.J. (*In preparation for Nature*) Nutrition and the rise of fungus farming in ants

Shik, J.Z., Boomsma, J.J., Baer, B. (*In preparation for Functional Ecology*) Physiological costs of sperm storage in living sperm banks, leafcutter ant queens.

GRANTS AND AWARDS

2014	BIO Incentive grant to support international PhD course (U. Copenhagen), \$10,600
2013	Marie Curie International Incoming Postdoctoral Fellowship, \$282K Smithsonian Tropical Research Institute, Postdoctoral Fellowship, \$65K
2012	Association for Biology Lab Instructors Conference, Major Workshop, \$200 honorarium
2011	National Inst. for Mathematical and Biological Synthesis, short term research grant: \$2,000
2004-2010	Alumni Fellowship from the Graduate College at the University of Oklahoma: \$25,000 Graduate Research Supplemental Stipend, U. Oklahoma, Dept. Zoology: \$2,500
2009	University of Oklahoma Biostation, summer research grant: \$2,500
2008	NSF teaching grant to redesign introductory zoology: \$1,500 Adams Summer Research Fellowship: \$2,500 Gordon Research Conference on the Metabolic Basis of Ecology: Competitive stipend for delivering invited seminar: \$1,500
2007	Graduate Student Senate Research Stipend: \$440 Adams Summer Research Fellowship: \$2,500
2006	Adams Summer Research Fellowship: \$2,500
2005	Adams Summer Research Fellowship: \$2,500 Smithsonian Tropical Research Institute, Short Term Fellowship: \$2,500 Honorable Mention: NSF Graduate Research Fellowship

Presentations for Professional Meetings:

Kooij, P.W., Gaya, E., Shik, J.Z., Dentinger, B.T.M. (2016) 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. IUSSE 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. IUSSE 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 to 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. IUSSI 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.

Invited Presentations:

- 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
- 2015
 Jodrell Laboratory, Royal Botanic Gardens, Kew, London
 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
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 Training:

- 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

TEACHING

Graduate-level course organizer:

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| Tropical Behavioural Ecology and Evolution, field course at the Smithsonian Tropical Research Institute (Co-organizer, instructor), partnership with the University of Copenhagen | April - May 2011
April - May 2013
April - May 2015 |
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Undergraduate courses:

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| 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 |

SERVICEProfessional Service:Reviewer: Peer-Reviewed Journals

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

Reviewer: Grant Agencies

National Science Foundation

Professional Affiliations

Ecological Society of America

American Society of Naturalists

International Union for the Study of Social Insects

Institutional Service:Student Advising

2015-2016	Hosted and supervised ERASMUS student Pol Lannes Salvado from the University of Barcelona, Spain. Masters student at the University of Copenhagen, on attine nutritional ecology, Winnie Rytter
2013-2014	Masters student Angelo Concilio, University of Turino, Smithsonian Tropical Inst. Research Intern at the Smithsonian Tropical Research Institute, Mariana Franco Research Intern at the Smithsonian Tropical Research Institute, Ernesto Gomez
2011-2013	Supervised two undergraduate field assistants, Matt Green and Shanna Wood, during postdoctoral research at North Carolina State University.
2010	Supervised an NSF REU undergraduate, Deana Flatt, during her first trip to a tropical forest. Guided her as she assisted with my research and helped her develop her own project, which was published in <i>Naturwissenschaften</i>
2004-2009	Undergraduate Research Assistants in the Kaspari lab at the University of Oklahoma: Shelly Sudberry, Matt Dowling, Julie Miller, Risa Walters, Deanna Flatt

Guest Lectures

2013	Field Research Course for Latin American Researchers, Smithsonian Tropical Research Institute, Panama
2012	Organized workshop on ant ecology lab at the National Conference: Association for Biology Lab Instructors Conference, Chapel Hill, North Carolina
2011	Graduate Student Seminar in Insect Ecology, ' <i>Energy Flow, Nutrients, Ecosystem Function</i> ', North Carolina State University
2010	Undergraduate Zoology Society, ' <i>How to study ants</i> ', The University of Oklahoma Concepts in Biology, ' <i>Community ecology</i> ', The University of Oklahoma
2009	General Introductory Biology Lecture, ' <i>Community ecology and ants</i> ', U. Oklahoma
2005-2007	Entomology Course, ' <i>Hymenoptera</i> ', The University of Oklahoma

Committees

- 2009 Zoology representative in the graduate student senate
2008 Graduate student Zoology Department faculty representative
2007 Graduate student representative on Zoology Department admissions committee

Community Service:

Public outreach

- 2016 Consulted with the Copenhagen Zoo on a new exhibit on ecology and evolutionary biology and a new leafcutter ant husbandry project
- 2014,2015 Culture Night, organized the social insect booth, Copenhagen, Denmark
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 soon to be extended to Denmark and elsewhere.
- 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

- My 2016 PNAS paper had an Almetric score of 98, ranked in the 97th 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%99lunchbox%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)
- 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>)