

Sara Helms Cahan

Curriculum Vitae

Current Position : Associate Professor and Chair,
Department of Biology, University of Vermont

University address: Department of Biology
Marsh Life Sciences 307A
University of Vermont
Burlington, VT 05405

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Education:

1999 Ph.D. Zoology, Arizona State University, Tempe, AZ
Co-advisors: Steven W. Rissing and Jennifer H. Fewell
Major field: Behavioral Ecology

1992 B.S. Biology, University of Michigan, Ann Arbor, MI

Areas of Specialization:

Social insect biology and evolution, ecological genetics, behavioral ecology

Professional Employment:

2015 - current Chair, Department of Biology, University of Vermont
2010 – current Associate Professor, Department of Biology, University of Vermont
2004-2010 Assistant Professor, Department of Biology, University of Vermont
July 2000 - Postdoctoral Research Associate (with Laurent Keller)
 Aug. 2004 University of Lausanne, Switzerland
February- Post-doctoral Research Assistant (with S. Bradleigh Vinson)
 June 2000 Department of Entomology, Texas A&M University
1993 – 1999 Teaching Assistant
 Department of Biology, Arizona State University

Teaching Experience:

2005 - current Biology 381 Ecological Genetics (1 credit graduate colloquium)
 Levels of Selection (graduate colloquium)
 Foundational Readings in Social Evolution (graduate
 colloquium)
 Biology 277 Sociobiology (3 credits)
 Biology 276 Behavioral Ecology (3 credits)
 BioCore 012 Exploring Biology (4 credits), lecture and lab
 Honors 196 Sophomore Honors seminar: Natural History of The Family
 (3 credits)

Biology 095 First-year Teacher-Advisor-Program seminar “Natural History of the Family” (3 credits)

Grants:

- 2013-2014 National Science Foundation, Broadening Participation Research Experience for Undergraduates (REU) supplement to Dimensions of Diversity Program grant (\$20,000).
- 2012-2017 National Science Foundation, Ecology of Infectious Diseases Program. “Modeling disease transmission using spatial mapping of vector-parasite genetics and vector feeding patterns.” Awarded to L. Stevens, D. Rizzo, L. Morrissey, S. Helms Cahan (\$2,461,995).
- 2012-2015 National Science Foundation, Dimensions of Diversity Program. “Collaborative Research: The Climate Cascade: functional and evolutionary consequences of climate change on species, trait and genetic diversity in a temperate ant community.” Awarded to B. Ballif, R. R. Dunn, A. M. Ellison, N. J. Gotelli, S. Helms Cahan & N.J. Sanders (Total award \$1,997,320; UVM portion \$687,559).
- 2009-2013 National Science Foundation, Evolutionary Processes Program. “Genetic Architecture and Evolution of Reproductive Caste Determination in Harvester Ants.” (\$800,000)
- 2008-2011 National Science Foundation, Population Biology Cluster. “Evolution of Major Geographic Variation in Social Behavior of a Desert Ant.” Awarded to K. R. Helms and S. Helms Cahan (\$506,000).
- 2008-2009 Vermont Genetics Network Proteomics Facilities Award. “Pilot project: Regional variation in the behavior of ant queens as a model system.” Awarded to S. Helms Cahan and K. R. Helms (\$4,991)
- 2006 University of Vermont Faculty Research Award. “Linkage mapping of genes involved in worker development in ants: a pilot study.” (\$15,000)
- 2001-2006 Earthwatch Institute/Durfee Foundation Student Challenge Award Project grants (\$10,000 – \$12,000 awarded per annum)
- 2002 Field Research Grant, Swiss Society of Naturalists (\$3000)
- 1998 Travel Grant, International Union for the Study of Social Insects (\$1,450)
Travel Grant, Arizona State University Dept. of Biology (\$365)
Travel Grant, Arizona State University Graduate College (\$300)
- 1996 Dissertation Improvement Grant, National Science Foundation (\$9,980)
- 1994, 1995 Research Grants, Arizona State University Dept. of Zoology (\$360, \$300)

Refereed, Peer-Reviewed Publications:

- Stanton-Geddes, J., A. Nguyen, L. Chick, J. Vincent, M. Vangala, R. R. Dunn, A. M. Ellison, N. J. Sanders, N. J. Gotelli, and S. Helms Cahan 2016. Thermal reactionomes reveal divergent responses to thermal extremes in warm and cool-climate ant species. *BMC Genomics* DOI: 10.1186/s12864-016-2466-z.
- Nguyen, A., N. Gotelli and S. Helms Cahan, 2016. Sequence, cis-regulatory evolution and expression profile of ant heat shock proteins. *BMC Evolutionary Biology* DOI: 10.1186/s12862-015-0573-0.

- Muscudere, M., S Helms Cahan, K. R. Helms, and J. F. Traniello, 2016. Geographic and life-history variation in ant queen colony founding correlate with brain amine levels. *Behavioral Ecology* 27:271-278.
- Smith, C. R., S. Helms Cahan, C. Kemena, S. G. Brady, W. Yang, E. Bornberg-Bauer, T. Eriksson, J. Gadau, M. Helmkampf, D. Gotzek, M. O. Miyakawa, A. Suarez, and A. Mikheyev, 2015. How do genomes create novel phenotypes? Insights from the loss of the worker caste in ant social parasites. *Molecular Biology and Evolution* 32:2919-2931.
- Gotzek, D., H. J. Axen, A. Suarez, S. Helms Cahan, and D. Shoemaker, 2015. Global invasion history of the Tropical Fire Ant, *Solenopsis geminata*: A stowaway on the first global trade routes. *Molecular Ecology* 24:374-388.
- Herrmann, M. and S. Helms Cahan 2014. Inter-genomic sexual conflict drives antagonistic coevolution in harvester ants. *Proceedings of the Royal Society of London B* 281:20141771.
- Helms Cahan, S and K. R. Helms 2014. Variation in social structure alters queen body mass and productivity in the desert seed-harvester ant *Messor pergandei*. *Insectes Sociaux* 61:153-161.
- Axen, H. J., A. Wildermuth and S. Helms Cahan 2014. Environmental filtering of foraging strategies mediates patterns of coexistence in the fire ants *Solenopsis geminata*, *Solenopsis xyloni*, and their interspecific hybrids. *Ecological Entomology* 39:290-299.
- Helms, K.R., N. J. Newman and S. Helms Cahan 2013. Regional variation in queen and worker aggression in incipient colonies of the desert ant *Messor pergandei*. *Behavioral Ecology and Sociobiology* 67:1563-1573.
- Helms Cahan, S. and E. Gardner-Morse 2013. Emergence of reproductive division of labor in forced queen groups of the ant *Pogonomyrmex barbatus*. *Journal of Zoology* 291:12-22.
- Abbott, R. *et al.* (I am one of 40 co-authors), 2013. Hybridization and Speciation. *Journal of Evolutionary Biology* 26:229-246.
- Zhou, Y. and S. Helms Cahan 2012. A novel family of terminal-repeat retrotransposon in miniature (TRIM) in the genome of the red harvester ant, *Pogonomyrmex barbatus*. *PLoS One* 7:e53401.
- Helms Cahan, S. and K. R. Helms 2012. Relatedness does not explain geographic variation in queen cooperation in the seed-harvester ant *Messor pergandei*. *Insectes Sociaux* 59:579-585.
- Helms, K. R. & S. Helms Cahan 2012. Large scale regional variation in cooperation, conflict, group size, and cooperative breeding among queens of the desert ant *Messor pergandei*. *Animal Behaviour* 84:499-507.
- Helms Cahan, S., Graves, C. J., Brent, C. S., 2011. Intergenerational effect of maternal juvenile hormone on offspring in *Pogonomyrmex* harvester ants. *Journal of Comparative Physiology B* 181:991-999.
- Helms Cahan, S., Daly, A. M., Schwander, T., Woods, H. A. 2010. Genetic caste determination does not reduce colony growth rates in *Pogonomyrmex* harvester ants. *Functional Ecology* 24:301-309.

- Helms Cahan, S., Julian, G. E. 2010. Shift in frequency-dependent selection across the life-cycle in obligately interbreeding harvester ant lineages. *Evolutionary Ecology* 24:359-374.
- Helms, K. R. and S. Helms Cahan, 2009. Divergence in mating flight patterns of the seed-harvester ant *Pogonomyrmex rugosus* Emery, (1895) in the western Mojave Desert. *Myrmecological News* 13:15-17.
- Schwander, T., Helms Cahan, S., S. Suni, Keller, L. 2008. Mechanisms of reproductive isolation between an ant species of hybrid origin and its parents. *Evolution* 62:1635-1643.
- Schwander, T., Humbert, J.-Y., Brent, C. S., Helms Cahan, S., Chapuis, L., Renai, E., Keller, L. 2008. Maternal effect on female caste determination in a social insect. *Current Biology* 18:265-269.
- Schwander, T., Keller, L., Helms Cahan, S. 2007. Two alternate mechanisms contribute to the persistence of interdependent lineages in *Pogonomyrmex* harvester ants. *Molecular Ecology* 16:3533-3543.
- Schwander, T., Helms Cahan, S., Keller, L. 2007. Characterization and distribution of *Pogonomyrmex* harvester ant lineages with genetic caste determination. *Molecular Ecology* 16:367-387.
- Helms Cahan, S. Julian, G. E., Schwander, T., Keller, L. 2006. Reproductive isolation between the harvester ant *Pogonomyrmex rugosus* and two lineages with genetic caste determination. *Ecology* 87:2160-2170.
- Julian, G. E., Helms Cahan, S. 2006. Behavioral differences between *Pogonomyrmex rugosus* and two dependent lineages (H1/H2). *Ecology* 87:2207-2214.
- Schwander, T., Helms Cahan, S., Keller, L. 2005. Genetic caste determination in *Pogonomyrmex* harvester ants imposes costs during colony founding. *Journal of Evolutionary Biology* 19:402-409.
- Helms Cahan, S., Rissing, S.W. 2005. Variation in queen size across a behavioral transition zone in the ant *Messor pergandei*. *Insectes Sociaux* 52:84-88.
- Helms Cahan, S., Julian, G. E., Rissing, S. W., Schwander, T., Parker, J. D., Keller, L. 2004. Loss of phenotypic plasticity explains genotype-caste association in harvester ants. *Current Biology* 14: 2277-2282.
- Parker, J. D., Ziemba, R. E., Helms Cahan, S., Rissing, S. W. 2004. An hypothesis-driven molecular phylogenetics exercise for college biology students. *Biomedical and Molecular Biology Education* 32:108-114.
- Helms Cahan, S., Fewell, J. H. 2004. Division of labor and the evolution of task sharing in queen associations of the harvester ant *Pogonomyrmex californicus*. *Behavioral Ecology and Sociobiology* 56:9-17.
- Helms Cahan, S., Keller, L. 2003. Complex hybrid origin of genetic caste determination in harvester ants. *Nature* 424:306-309.
- Helms Cahan, S., Vinson, S. B. 2003. Reproductive division of labor between hybrid and non-hybrid offspring in a fire ant hybrid zone. *Evolution* 57:1562-1570.
- Helms Cahan, S., Parker, J. D., Rissing, S. W., Johnson, R. A., Polony, T. S., Weiser, M.D., Smith, D.R. 2002. Extreme genetic differences between queens and workers in hybridizing *Pogonomyrmex* harvester ants. *Proceedings of the Royal Society of London, Series B* 269:1871-1877.

- Helms Cahan, S., Blumstein, D.T., Sundström, L., Liebig, J. and Griffin, A. 2002. Social trajectories and the evolution of social behavior. *Oikos* 96:206-216.
- Helms Cahan, S., 2001. Ecological variation across a behavioral transition zone in the ant *Messor pergandei*. *Oecologia* 129:629-635.
- Helms Cahan, S. 2001. Co-operation and conflict in ant foundress associations: insights from geographical variation. *Animal Behaviour* 61:819-825.
- Cahan, S. and Julian, G. E. 1999. Fitness consequences of cooperative colony founding in the leaf-cutter ant *Acromyrmex versicolor*. *Behavioral Ecology* 10:585-591.
- Julian, G.E. and Cahan, S. 1999. Undertaking specialization in the desert leaf-cutter ant, *Acromyrmex versicolor*. *Animal Behaviour* 58:437-442.
- Cahan, S., Carloni, E., Liebig, J., Pen, I. and Wimmer, B. 1999. Causes and consequences of sociality. *Ethology Ecology and Evolution* 11: 85-87.
- Cahan, S., Helms, K. R. and Rissing, S. W. 1998. An abrupt transition in colony founding behaviour in the ant *Messor pergandei*. *Animal Behaviour* 55:1583-1594.

Work in progress:

Manuscripts submitted:

- Diamond, S.E., L. M. Nichols, S. L. Peline, C. Penick, S. Helms Cahan, G. Barber, R. R. Dunn, Aaron M. Ellison, N. J. Sanders, and N. J. Gotelli. Climate warming alters species interaction and destabilizes forest ant communities. To *Science*.

Manuscripts in preparation:

- Helms Cahan, S., G. Cosgrove, G. and J. Stanton-Geddes. Juvenile hormone increases propensity to forage but does not influence ovarian development in harvester ant workers. Draft in progress, for *Insectes Sociaux*.
- Helms Cahan, S. A. D. Nguyen, J. Stanton-Geddes, C. Penick, Y. Hernáiz-Hernández and N. J. Gotelli. Modulation of the heat shock response underlies acclimation to novel temperatures but not adaptation to climatic variation in woodland ants in the genus *Aphaenogaster*. Draft in progress, for *Journal of Evolutionary Biology*.

Invited Seminars/Papers:

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| 2014 | Entomological Society of America Annual meeting, invited symposium speaker |
| 2010 | International Congress of the International Union for the Study of Social Insects, Copenhagen, Denmark (invited talk) |
| 2009 | Boston University |
| 2008 | University of Nevada, Las Vegas |
| 2007 | University of Massachusetts, Amherst |
| 2006 | Entomological Society of America Annual Meeting, Invited Symposium |
| 2005 | University of New Hampshire, Durham, NH |
| 2004 | University of Illinois, Champaign-Urbana, IL |

- 2003 Entomological Society of America Annual Meeting, Invited Symposium
(G.E. Julian and S. Helms Cahan)
SUNY Stony Brook, NY
Vanderbilt University, Nashville, TN
- 2002 University of Copenhagen, Copenhagen, Denmark
- 2001 Animal Behavior Society Annual Meeting, Invited Symposium (J.H.
Fewell and S. Helms Cahan)
University of Würzburg, Germany
University of Lausanne, Switzerland
University of Houston, TX

Contributed papers:

- 2015 Conference on Biological Stoichiometry, Peterborough, Canada (poster)
Ecological Society of America annual meeting (poster)
- 2014 Entomological Society of America Annual meeting, Baltimore, MD (1
student oral presentation, 1 student poster)
Society of the Study of Evolution annual conference, Raleigh, NC (two
contributed talks, two posters)
- 2013 Arthropod Genomics annual conference, South Bend, IN (poster)
- 2012 International Union for the Study of Social Insects North American section
meeting, Greensboro, NC (1 talk: M. Herrmann & S. Helms
Cahan; 3 posters: Y. Hernáiz-Hernández & S. Helms Cahan; A.
Nguyen, S. Helms Cahan & N. Gotelli; S. Helms Cahan & E.
Gardner-Morse)
- 2011 EU FRoSPECTS workshop: Hybridization and Speciation, Newtown, UK
(contributed topic proposal, selected for inclusion in published
manuscript).
- 2010 International Congress of the International Union for the Study of Social
Insects, Copenhagen, Denmark (1 talk, with K. R. Helms, 1 poster,
with H. J. Axen and L. Keller)
- 2009 Entomological Society of America Annual Meeting, Indianapolis, IN (S.
Helms Cahan & K. R. Helms)
Ant Genomics Consortium Workshop, Tempe, Arizona (oral presentation)
- 2008 International Union for the Study of Social Insects North American section
meeting (2 talks: S. Helms Cahan, A. M. Daly, & T. Schwander;
and H. J. Axen, C. Mallon & S. Helms Cahan)
Society for the Study of Evolution Annual Meeting (H. Axen, C. Mallon,
& S. Helms Cahan)
Society for Mathematical Biology Annual Meeting (2 posters: P. S.
Goodman, S. Helms Cahan & C. Danforth; and J. Glenister, C.
Danforth & S. Helms Cahan)
- 2007 Society for Mathematical Biology Annual Meeting (P. S. Goodman, S.
Helms Cahan & R. Rajbhandari)
- 2006 International Union for the Study of Social Insects International
Congress (2 posters: K. P. O'Connor, S. Helms Cahan & K. R.
Helms; Julian, G. E. & S. Helms Cahan)
Society for the Study of Evolution Annual Meeting (T. Schwander, L.
Keller & S. Helms Cahan)
- 2005 Entomological Society of America Annual Meeting
- 2003 Society for the Study of Evolution Annual Meeting

- 2002 INSECTS European Union Network Midterm Meeting, Germany
International Union for the Study of Social Insects International Congress, Sapporo, Japan (with J. H. Fewell)
- 2000 International Society for Behavioral Ecology
Social Systems and Population Genetics Conference, La Sage, Switzerland
- 1999 Animal Behavior Society Annual Meeting.
Animal Behavior Society Annual Meeting (G.E. Julian and S. Cahan)
Murray J. Littlejohn Symposium (with J.H. Fewell)

University Service

Member of the College of Arts and Sciences Faculty Standards committee, 2012 - current
(elected position)

Co-director of the Integrated Biological Sciences program, 2010 – current

Member of University Committee on Teacher Education, 2009-2011

Member of College of Arts and Sciences Honors Committee, 2008-2011 (elected position)

Member of Faculty Research Awards committee, 2007-2008

Member of Faculty Development Awards committee, 2006-2008

Member of John Dewey Honors Program Advisory Council, 2005-2008

Member of Biology Department Advisory Committee, 2005-2006

Member of Biology Department Graduate Affairs Committee, 2005-current

Faculty Advisor, Zoology, Environmental Sciences and Biology Network, 2005-2006

Faculty Advisor, tri-Beta National Biology Honors Society, 2006-2012

Post-doc advisor for:

Yihong Zhou (2010-2013)

John Stanton-Geddes (co-mentored with N. Gotelli, 2013-2014)

Ph.D. Advisor for:

Heather Axen (graduated August 2011)

Fernando Gelin (graduated May 2014)

Michael Herrmann

Katie Miller (NSF GRFP Fellow, 2014-2016)

Andrew Nguyen (co-advised with N. Gotelli)

Lucia Orantes (co-advised with K. Wallin, RSENR)

M.S. Advisor for:

Trevor Manendo (graduated May 2008)

Yainna Hernáiz-Hernández (graduated May 2015)

Current Ph.D. Committee Member for:

Samantha Alger, Biology

Christian Dambros, Biology

Federico Lopez-Osorio, Biology

Nabil Nasser, Biology

Amanda Northrop, Biology

Sohath Vanegas, Biology

Mercy Hyde, College of Social Work

Current MS Committee member for:

Christopher Gray, Biology
Victoria Pinheiro, Natural resources
Beck Powers, Plant Biology

Service to Scientific Community:

Associate editor, *Evolutionary Ecology* (2006-current)

Member of Advisory Council of AMNH Southwestern Research Station (2005-2007)

Journal Referee for: *American Naturalist*, *Animal Behaviour*, *Behavioral Ecology and Sociobiology*, *Biology Letters*, *Current Biology*, *Ethology*, *Evolution*, *Insectes Sociaux*, *Journal of Theoretical Biology*, *Molecular Ecology*, *Molecular Phylogeny and Evolution*, *Naturwissenschaften*

Member of NSF Evolutionary Ecology grant proposal review panel, spring 2010

Member of NSF Animal Behavior grant proposal review panel, fall 2010

Member of NSF Dimensions of Biodiversity grant proposal review panel, summer 2013

Member of NSF Evolutionary Processes pre-proposal review panel, spring 2014

Professional Memberships:

Animal Behavior Society

American Society of Naturalists

Entomological Society of America

International Society for Behavioral Ecology

International Union for the Study of Social Insects