Joseph Dauer

Associate Professor of Life Science Education

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University of Nebraska-Lincoln
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Professional Preparation (Education)

2007 Ph. D. Ecology, The Pennsylvania State University, University Park, PA
Dissertation Title: From emergence to impact: the role of the environment in facilitating dispersal of *Conyza canadensis*
Advisor: Dr. David Mortensen

2004 M.S. Ecology, The Pennsylvania State University, University Park, PA
Thesis Title: Long-distance dispersal of horseweed, *Conyza canadensis*, seed
Advisor: Dr. David Mortensen

2001 B.S. Biology/Mathematics, Western Washington University, Bellingham, WA
Advisors: Dr. Merrill Peterson and Dr. Sebastian Schreiber

Appointments

2019- **Associate Professor of Life Sciences Education**, School of Natural Resources
University of Nebraska-Lincoln, Lincoln, NE

2013-19 **Assistant Professor of Life Sciences Education**, School of Natural Resources
University of Nebraska-Lincoln, Lincoln, NE

2010-13 **Research Associate**, Michigan State University, East Lansing, MI
Advisor: Dr. Tammy Long

2008-10 **Postdoctoral Researcher**, Oregon State University, Corvallis, OR
Advisors: Dr. Carol Mallory-Smith and Dr. Andrew Hulting

2007 **Postdoctoral Researcher**, Oregon State University, Corvallis, OR
Advisor: Dr. Peter McEvoy

Publications *(advised postdocs, #graduate or* *undergraduate*)*

34. Dauer, J.T., J.M. Dauer, *L. Lucas,* T. Helikar, and T. Long. *In Press.* Supporting university student learning of complex systems: an example of teaching the interactive processes that constitute photosynthesis. In *Understanding Complexity in Biology Education*, eds M.C.P. Knippels and O. Ben-Zvi Assaraf.

33. Mayes, R., D. Owens, **J.T. Dauer**, K. Rittschof. *In Press.* Quantitative Reasoning in Biology. *Applied and Computational Mathematics*.

32. #Spier. S. and **J.T. Dauer**. *In Press*. Sexual Selection as a Tool to Improve Student Reasoning of Evolution. *American Biology Teacher*.

31. **Dauer, J.T.**, R. Mayes, K. Rittschoff and B. Gallant. 2021. Assessing Quantitative Modelling Practices, Metamodelling, and Capability Confidence of Biology Undergraduate Students. *International Journal of Science Education*. https://doi.org/10.1080/09500693.2021.1928325

30. Clark, C.A., T. Helikar, and **J.T. Dauer**. 2020. Simulating a Computational Biological Model, Rather Than Reading, Elicits Changes in Brain Activity during Biological Reasoning. *CBE—Life Sciences Education* 19, no. 3 (September 1, 2020): ar45. https://doi.org/10.1187/cbe.19-11-0237

29. **Dauer, J.T.,** *H. Bergan-Roller*, *G.P. King*, *McKenzie Kjose, N. Galt, and T. Helikar. 2019. Changes in Students' Mental Models from Computational Modeling of Gene Regulatory Networks. *International Journal of STEM Education* 6 (1): 38. https://doi.org/10.1186/s40594-019-0193-0

28. *King, G.P.*, *H. Bergan-Roller*, N. Galt, T. Helikar, and **J.T. Dauer**. 2019. Modelling Activities Integrating Construction and Simulation Supported Explanatory and Evaluative Reasoning. *International Journal of Science Education* 41 (13): 1764–86. https://doi.org/10.1080/09500693.2019.1640914.

27. Mayes, R., K. Rittschof, **J.T. Dauer**, and B. Gallant. 2019. Quantitative Modelling Biology Undergraduate Assessment. *Letters in Biomathematics*, September 24, 2019, 1–27. https://doi.org/10.1080/23737867.2019.1653234.

26. *Crowther, Audrey, *H.E. Bergan-Roller*, N. Galt, L. Appleby, **J.T. Dauer**, and T. Helikar. 2019. Discovering Prokaryotic Gene Regulation by Building and Investigating a Computational Model of the *Lac* Operon. *CourseSource* 6. https://doi.org/10.24918/cs.2019.4.

25. *Bergan-Roller, H.*, N. Galt, T. Helikar, and **J.T. Dauer**. 2020. Content and organization of student knowledge of cellular respiration in undergraduates. *Journal of Biological Education.* 54: 33-46. https://doi.org/10.1080/00219266.2018.1541001

24. *Crowther A., *H. Bergan-Roller*, N. Galt, **J.T. Dauer**, and T. Helikar. 2018. Discovering Prokaryotic Gene Regulation with Simulations of the *trp* Operon. *CourseSource*. doi:10.24918/cs.2018.9

23. *Bergan-Roller, H.*, N. J. Galt, C. Chizinski, T. Helikar, and **J.T. Dauer**. 2018. Simulated Computational Model Lesson Improves Systems Thinking in Biology Students. *BioScience*. 68:612-621. https://doi.org/10.1093/biosci/biy054

22. **Dauer, J.T.**, A. Hulting, D. Carlson, J. Harden, L. Mankin, and C. Mallory-Smith. 2018. Gene flow from single and stacked herbicide-resistant rice: modeling occurrence of multiple herbicide-resistant red rice. *Pest Management Science.* 74:348-355.

21. #Sabel, J. L., **J.T. Dauer**, C. Forbes. 2017. Introductory Biology Students' Use of Rubrics and Reflection Questions to Engage in Metacognition and Enhance Understanding. *CBE- Life Sciences Education.* 16(3):ar40.

20. *Bergan-Roller, H.*, N. Galt, **J.T Dauer**, and T. Helikar. 2017. Discovering Cellular Respiration with Computational Modeling and Simulation. *CourseSource.* https://doi.org/10.24918/cs.2017.10

19. **Dauer, J.T.** and J.M. Dauer. 2016. A framework for understanding the characteristics of complexity in biology. *International Journal of STEM Education*. 3:13. https://doi.org/10.1186/s40594-016-0047-y

18. Kowal, B., T.R. Schreier, **J.T. Dauer**, and T. Helikar. 2016. Programmatic Access to Cell Collective models via a REST API. *BioSystems*. 139: 12-16.

17. **Dauer, J.T.** and T.M. Long. 2015. Long-term conceptual retrieval by college biology majors following model-based instruction. *Journal of Research in Science Teaching.* 52(8):1188-1206.

16. Jongejans, E., O. Skarpaas, M. Ferrari, E. Long, **J.T. Dauer**, C. Schwarz, E. Rauschert, R. Jabbour, D.A. Mortensen, S. Isard, D. Lieb, Z. Sezen, A. Hulting, K. Shea. 2014. A Unifying gravity framework for dispersal. *Theoretical Ecology*. 8(2):207-223.

15. Long, T.M., **J.T. Dauer**, K.M. Kostelnik, J.L. Momsen, S.A. Wyse, and D. Ebert-May. 2014. Designing Instruction to Foster Ecoliteracy Skills in Undergraduate Biology Education. *Frontiers in Ecology and the Environment.* 12(2): 138-139.

14. **Dauer, J.T.**, J.L. Momsen, E. Bray-Speth, *S. Makohon-Moore, and T.M. Long. 2013. Analysis of Student-Constructed Models of Complex Biological Systems. *Journal of Research in Science Teaching*. 50(6):639-659.

13. **Dauer, J.T.** and E. Jongejans. 2013. Elucidating the population dynamics of Japanese knotweed using integral projection models. *PLoS ONE* 8 (9):e75181.

12. Hulting, A., **J.T. Dauer**, B. Hinds-Cook, D. Curtis, R. Koepke-Hill, and C. Mallory-Smith. 2012. Management of Italian Ryegrass (*Lolium perenne ssp. multiflorum*) in Western Oregon with preemergence applications of pyroxasulfone in winter wheat. *Weed Technology* 26(2): 230-235.

11. **Dauer, J.T.**, P.B. McEvoy, and J. Van Sickle. 2012 Controlling an invasive plant species by targeted disruption of its life cycle. *Journal of Applied Ecology* 49:322-330.

10. Felix, J., **J.T. Dauer**, A. Hulting, and C. Mallory-Smith. 2012. Yellow nutsedge growth and tuber production in response to increasing glyphosate rates and selected adjuvants. *Weed Technology* 26: 95-101.

9. Rauschert, E. S. J., **J.T. Dauer**, J. L. Momsen, and A. Sutton-Grier. 2011. Primary literature across the undergraduate curriculum: teaching science process skills and content. *Bulletin of the Ecological Society of America* 92:396–405.

8. **Dauer, J.T.**, E.C. Luschei, and D.A. Mortensen. 2009. Effects of glyphosate-resistant crop adoption on the connectivity of a landscape: an herbicide-resistant weed perspective. *Landscape Ecology* 24(6): 735-747.

7. **Dauer, J.T.**, D.A. Mortensen, E.C. Luschei, S. Isard, E. Shields, and M.J. VanGessel. 2009. *Conyza canadensis* seed ascent in the lower atmosphere. *Agricultural and Forest Meteorology.* 149: 526-534.

6. DiTommaso, A., Clements, D.R., Darbyshire, S.J., and **J.T. Dauer**. 2009. The Biology of Canadian Weeds 143. *Apocynum cannabinum* L.. *Canadian Journal of Plant Science*. 89:977-992.

5. **Dauer, J.T.**, D.A. Mortensen, and M.J. VanGessel. 2007. Temporal and spatial dynamics of long-distance *Conyza canadensis* seed dispersal. *Journal of Applied Ecology* 44(1): 105-114.

4. Menalled, F.D., R.G. Smith, **J.T. Dauer**, and T. Fox. 2007. Impact of agricultural management systems on carabid beetle communities and invertebrate weed seed predation. *Agriculture, Ecosystems and Environment* 118: 49-54.

3. Shields, E.J., **J.T. Dauer,** M.J. VanGessel, and G. Neumann. 2006. Horseweed *(Conyza canadensis)* seed collected in the planetary boundary layer. *Weed Science* 54: 1063-1067.

2. **Dauer, J.T.**, D.A. Mortensen, and R. Humston. 2006. Controlled environment experiments to predict dispersal distances of horseweed (*Conyza canadensis*) seed. *Weed Science* 54: 484-489.

Outstanding Paper in Weed Science (Weed Science Society of America)

1. Menalled, F., **J.T. Dauer**, T. Fox, and Renner, K. 2001. Managing your farm to increase weed-seed predation. Extension Bulletin E-2740, Michigan State University. February 2001.

Funded Research Projects

2020 ECR DBER DCL: Describing the neurobehavioral effects of modeling-based instruction in undergraduate life sciences education (NSF-DUE 2000549). **J. Dauer**, C. Clark, T. Long. Total $313,907.

Quantitative Modeling in Biology Undergraduate (QM BUG) Courses: Teaching Approaches and Student Outcomes (NSF-DUE 2021103). **J. Dauer** and B. Couch. $402,511.

2019 Innovating life sciences education through computational modeling and simulations. National Science Foundation, EHR Improving Undergraduate Stem Education (NSF-DUE 1915131). T. Helikar, W. Smith, and **J. Dauer**. Total $1,896,570.

2018 Describing the Neural Effects of Modeling-Based Instruction. University of Nebraska-Lincoln. C. Clark, **J. Dauer**, and T. Helikar. Total $5,000.

2014 Computational Modeling of Biological Systems. National Science Foundation, EHR Improving Undergraduate Stem Education (NSF-DUE 1432001). T. Helikar and **J. Dauer**. Total $2,321,012

From atoms to ecosystems: Investigating undergraduate student reasoning across biological scales. UNL Office of Research and Economic Development. **J. Dauer** and B. Couch. Total $28,855

2009 Quantifying Management Success of Japanese Knotweed. U.S. Department of Agriculture – Food and Agricultural Science Enhancement Post-Doctoral Fellowship. **J. Dauer**. Total $125,000

Modeling gene flow between herbicide resistant crops and weeds. BASF Corporation. **J. Dauer**, C. Mallory-Smith, and A. Hulting. Total $32,000

2005 *Polygonum cuspidatum* seed and fragment retention time in water and effects on seedling establishment rate. Weed Science Society of America – Undergraduate Research Grants. Sponsor for Undergraduate PI D. Heggenstaller. Total $1,000

Weed Seed Dispersal into the Planetary Boundary Layer. Penn State College of Agricultural Sciences – Competitive Grants Program. **J.Dauer**. Total $2,000

Teaching Experience

Courses instructed:

2014-21 Fundamentals of Biology II, Instructor
University of Nebraska-Lincoln, Lincoln, NE

2018-21 Teaching Undergraduate Science
University of Nebraska, Lincoln, NE

2017-21 Principles of Ecology
University of Nebraska, Lincoln, NE

2012 Biological Science – Organisms and Populations, Co-Instructor
Michigan State University, East Lansing, MI

Guest Lectures:

2012-13 Experiments in Plant Biology, Michigan State University
2010-11 Biology of Plants, Michigan State University
2010 Biological Science - Organisms and Populations, Michigan State University
2010 Experimental Design, Oregon State University
2008-9 Human Ecology, Oregon State University

Curriculum Development and Training:

2018-19 Rwanda Institute for Conservation Agriculture (https://www.rica.rw/)

2015-17 Quantitative Undergraduate Biology Education and Synthesis (https://qubeshub.org)

2014 National Academies Summer Institute (http://www.academiessummerinstitute.org)

2013 Introductory Biology Project (http://ibp.ou.edu)

2009-10 Faculty Institutes for Reforming Scientific Teaching (http://www.firstiv.org)

Student and Postdoctoral Mentoring

Postdoctoral Scholars

2019- Dr. Lyrica Lucas

2017-19 Dr. Gretchen King

2015-17 Dr. Heather Bergan-Roller

Graduate Students

2021- Anum Khushal, University of Nebraska-Lincoln
Quantitative modeling teaching and learning

2016-19 Sarah Spier, University of Nebraska-Lincoln

Traffic noise and sexual selection: studies of anthropogenic impact on bird songs and undergraduate student reasoning of evolutionary mechanisms.

2014-15 Nathan Niosco, University of Nebraska-Lincoln
Studying introductory biology students' understanding of quantitative relationships and hidden dimensions of food web dynamics.

Undergraduate Student Researchers

2021 McKenna Elliott, University of Nebraska-Lincoln
Undergraduate Students' Confidence & Accuracy in Detecting Errors in Biological Models Related to GPA

2019 Marius Dongmo, University of Nebraska-Lincoln
Student explanations and predictions during modeling activities impacts learning gains. Findings presented at UNL Undergraduate Research.

2018 Taylor Uhlir, University of Nebraska-Lincoln
Student understanding of creating and transferring recombinant DNA to create genetically modified organisms. Findings presented at UNL Undergraduate Research.

2016 McKenzie Kjose, University of Nebraska-Lincoln
Studying student knowledge of the *lac* operon system of gene regulation in prokaryotes. Findings presented at UNL Undergraduate Research Fair and incorporated into upcoming publication.

Professional Development

2021-22 University of Nebraska-Lincoln, Deep Dive into Course Equity Data

2019 University of Nebraska-Lincoln, Course (Re)Design

National Society for Experiential Education, Experiential Education Academy

AAC&U, Institute on High-Impact Practices and Student Success

2018 University of Nebraska-Lincoln, Student Success Fellows Program

2015-17 Quantitative Undergraduate Biology Education and Synthesis (QUBES), Teaching quantitative biology working group

2016 University of Nebraska-Lincoln, Alan Alda Center for Communicating Science Workshop

2015 University of Nebraska-Lincoln, Adopting Research Based Instruction al Strategies for Enhancing (ARISE) – Faculty Learning Community

2014 University of Nebraska-Lincoln, Research Development Fellows Program

Academic Service

2018 - CourseSource Journal Managing Editor (Ecology)

2016 - LIFE (Introductory Biology) Oversight Committee

2018- School of Natural Resources Graduate Committee

2018- School of Natural Resources Undergraduate Curriculum Committee

2020-21 Peer Evaluation of Teaching Task Force

Faculty Equity in Evaluation Task Force

2019-21 Secretary, Society for Advancement of Biology Education Research

2019 Co-author faculty tips to integrate Husker Student P.O.W.E.R. into classroom experiences to improve student success

Presentations

Postdocs [#]Graduate Student; *Undergraduate Researcher

Invited Talks

2020 **Dauer, J.T**, University of Minnesota Biology Teaching and Learning Dept. "Exploration of Cognitive and Neural Processes Used by Undergraduate Biology Students during Modeling"

2019 **Dauer, J.T**, Michigan State University CREATE for STEM "Exploration of Cognitive and Neural Processes Used by Undergraduate Biology Students during Modeling"

2017 **Dauer, J.T**, University of Memphis "Modeling to Learn Biology: Research on how students construct and interpret biological system models"
Dauer, J.T, South Dakota State University "Comparison of student learning while investigating versus building models of biological systems"

2016 **Dauer, J.T**, UNL STEM Education Seminar Series "Building versus Investigating Models of Regulation of Gene Expression"

2014 **Dauer, J.T**, North Dakota State University "Fix it or Forget it: Biology models to aide undergraduate student sense-making and knowledge retention."
Dauer, J.T, UNL STEM Education Seminar Series "Systems Thinking with Biology Models"

2013 **Dauer, J.T**, Xi'an Jiaontong University Visiting (to UNL) Scholars seminar "Modeling as a way of knowing science"
Dauer, J.T, Ecological Society of America Annual Meeting Symposium "Using Education Theory: Learning From the Past to Shape the Future of Ecology Teaching"

2012 **Dauer, J.T**, Kellogg Biological Station K12 Partnership "Going the distance: investigating dispersal across scales"
Dauer, J.T, Western Washington University "Comparing model-data feedback loops in ecological and education systems"

2007 **Dauer, J.T**, Northeast Weed Science Society Annual Meeting "How the spatial scale of dispersal modeling has changed with glyphosate-resistant horseweed."

2006 **Dauer, J.T**, North Central Extension Research Assoc - Committee on Migration and Dispersal of Biota "Trying to understand how seeds fly: the story of glyphosate-resistant horseweed."

Honors and Awards

2020 Holling Family Award for Teaching Excellence – Senior Faculty

2018 University of Nebraska-Lincoln
Student Success Fellows Program

2014 University of Nebraska-Lincoln
Research Development Fellows Program