Jacob M. Graving

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Education

2020 (expected) **Ph.D., Biology**
Focus: Collective Behavior
Department of Collective Behaviour, Max Planck Institute of Animal Behavior
Chair of Biodiversity and Collective Behaviour, University of Konstanz
Centre for the Advanced Study Collective Behaviour, University of Konstanz
International Max Planck Research School (IMPRS) for Organismal Biology

2015 **M.S., Biology**
Focus: Ethology, Neuroscience
Department of Biological Sciences, Bowling Green State University

2013 **B.S., Biology**
Focus: Ethology, Neuroscience
Department of Biological Sciences, Bowling Green State University

Publications

In Preparation Li, L., Nagy, M., **Graving, J.M.**, Bak-Coleman, J., Guangming X., Couzin, I.D. Schooling fish save energy by vortex-phase matching.
Graving, J.M., Couzin, I.D. A deep generative model for dimensionality reduction.

Preprints **Graving, J.M.**, Chae, D., Naik, H., Li, L., Koger, B., Costelloe, B.R., Couzin, I.D. Fast and robust animal pose estimation. bioRχiv, 620245 bioRχiv preprint: https://doi.org/10.1101/620245 DeepPoseKit on Github

2018 Alarcón-Nieto, G.*, **Graving, J.M.***, Klarevas-Irby, J.A.*, Maldonado-Chaparro, A.A., Mueller, I., and Farine, D.R. (2018) An automated barcode tracking system for behavioural studies in birds. Methods in Ecology and Evolution. bioRχiv preprint: https://doi.org/10.1101/201590 *contributed equally

2017 **Graving, J.M.**, Bingman, V.P., Hebets, E.A., and Wiegmann, D.D. (2017). Development of site fidelity in the nocturnal amblypygid *Phrynus marginemaculatus*. Journal of Comparative Physiology A, 203(5), 313-328.

Bingman, V.P., **Graving, J.M.**, Hebets, E.A., and Wiegmann, D.D. (2017). Importance of the antenniform legs, but not vision, for homing by the neotropical whip spider *Paraphrynus laevifrons*. Journal of Experimental Biology, 220(5), 885-890.
Press: Discover Magazine, National Geographic

2016 Wiegmann, D.D., Hebets, E.A., Gronenberg, W., **Graving, J.M.**, and Bingman, V.P. (2016). Amblypygids: model organisms for the study of arthropod navigation mechanisms in complex environments. Frontiers in Behavioral Neuroscience, 10, 47.

Research

2015–2019 **Max Planck Institute of Animal Behavior,**
Department of Collective Behaviour
University of Konstanz, Chair of Biodiversity and Collective Behaviour
Iain D. Couzin
"Perception and Motion in Animal Groups"

Studying how sensory information networks and internal state drive the collective dynamics of animal groups.

2011–2015 **Bowling Green State University, Department of Biological Sciences**
Daniel D. Wiegmann, Verner P. Bingman
"Navigation and Sensory Discrimination in Amblypygids"
Studied how amblypygids, a group of nocturnal arachnids, navigate home in the dark.

2013 **Bowling Green State University, Department of Biological Sciences**
Sheryl L. Coombs
"The Sensory Basis of Rheotaxis in Fish"
Studied how fish use multimodal sensory information to orient to flow.

2009 **SETGO Summer Research Scholar, Bowling Green State University**
Matthew L. Partin
"Phenotypic Plasticity in Photosynthetic Stony Corals"
Studied how genetically identical coral propagules adapt their morphology and physiology to changing environments.

Teaching

2016– **University of Konstanz, Chair of Biodiversity and Collective Behaviour**
Lecturer and Project Advisor, Intensive Research Course for Master's Students
– Collective Behavior of Locust Swarms
– Measuring Animal Behavior with Computer Vision
– Analyzing Behavioral Data
– Sensing, Perception, and Movement

2013–2015 **Department of Biological Sciences, Bowling Green State University**
Graduate Assistant
– Advanced Biostatistics (for Graduate Students)
– Introduction to Biostatistics
– Population and Community Ecology
– Introductory Biology for Non-Science Majors
– Guest Lecture on "Arthropod Navigation", Animal Behavior

2009-2012 **Bowling Green State University, Department of Biological Sciences**
Student Coordinator and Teaching Assistant, Marine Biology Laboratory
– Introduction to Inland Marine Research
– Aquarium Husbandry
– Reef Aquarium Husbandry I and II

2009 **Bowling Green State University, Department of Environmental Science**
Student Teaching Assistant, Introduction to Environmental Science

Funding

2013–2015 **Graduate Research Fellowship**
100% Tuition Waiver and $45,000 Stipend
Bowling Green State University

2013 **Undergraduate Research Fellowship**
$5000 Stipend, $800 Research Funds
Bowling Green State University, Center for Undergraduate Research and Scholarship

2009–2011 **T. Richard Fisher Biology Scholarship**
$8000/year Tuition Scholarship
Bowling Green State University, Department of Biological Sciences

2009 **Summer Research Fellowship**
$5000 Stipend, $1000 Research Funds

Science, Engineering, Technology Gateway Ohio (SETGO), National Science Foundation

2009–2013 **Award of Scholars**
Merit-based 75% Tuition Scholarship
Bowling Green State University, College of Arts and Sciences

Outreach

2017 **Konstanzer Lange Nacht Der Wissenschaft**
"Long Night of Science" Public Outreach Event
Volunteer
Konstanz, Germany

2016 **Das Schwarmverhalten der Fische**
Public Seminar by Prof. Jens Krause
Volunteer Co-organizer
Konstanz, Germany

2013–2014 **Kid's Tech University, Bowling Green State University**
Public Outreach Event for Schoolchildren Grades K–8
Volunteer
Bowling Green, Ohio, USA

2008–2010 **The Toledo Zoo Aquarium**
Volunteer and Intern
Toledo, Ohio, USA

Advisees

Graduate
Simon Gommel, M.S. Biology, University of Konstanz
Taylor Carter, M.S. Biology, University of Konstanz
Ingabritta Hormann, M.S. Biology, University of Konstanz

Undergraduate
Chiara Hirschkorn, B.S. Biology, University of Konstanz
Daniel Chae, B.S. Computer Science, Princeton University
Connie Santangelo, B.S. Biology, Bowling Green State University
Lindsey Cunningham, B.S. Biology, Bowling Green State University
Tracy Togba, B.S. Biology, Bowling Green State University

Peer Review

Journals: eLife, Science Advances, PNAS
Grants: IMPRS Project Grant, IMPRS Travel Grant

Skills

Computational
Languages: Python (Expert), R (Intermediate), MATLAB (Intermediate)
Applications: Bayesian inference, statistical analysis, data visualization, machine learning, deep learning, computer vision, and image processing
Libraries: Stan, tensorflow, keras, pytorch, scikit-learn, OpenCV

Biological
Physiology: electrophysiology, histology, opthalmoscopy, fish lateral line disruption and visualization
Microscopy: scanning and transmission electron microscopy, confocal, fluorescence, and general light microscopy

References

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Daniel D. Wiegmann
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Bowling Green State University
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Sheryl L. Coombs
Professor Emeritus
Bowling Green State University
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