

# CURRICULUM VITAE

**VERNER PETER BINGMAN**

1 March, 2024

Distinguished Research and Helen C. Seitz Endowed University Professor

Department of Psychology  
Bowling Green State University  
Bowling Green, Ohio 43403

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Date of Birth: 13 August 1954

Place of Birth: New York, New York

## EDUCATION

B.S. in Zoology, with Honors  
University of Wisconsin-Madison, 1976

M.S. in Zoology  
State University of New York-Albany, 1978

Ph.D. in Zoology  
State University of New York-Albany, 1981

## RESEARCH SUPPORT

Ohio Sea Grant Proposal Funding entitled: “The Effects of Lake Erie’s Island Archipelago on the Flight Orientation of Nocturnal Migratory Songbirds: Spring Migration and Fall Replication”, \$10,000, 2023-2024.

Ohio Sea Grant Proposal Funding entitled: “The Effects of Lake Erie’s Island Archipelago on the Flight Orientation of Nocturnal Migratory Songbirds”, \$10,000, 2022-2023.

United Arab Emirates University Program for Advanced Research 2021 entitled: “Landscapes, Nocturnal Flight and the Navigational Mechanisms of Homing Pigeons (I am Co-PI, the PI is Professor Sofyan Alyan at United Arab Emirates University), \$245,000, 2022-2026.

NSF Research Grant entitled: “Collaborative Research: Navigation and the Neural Integration of Multimodal Sensory Information in the Brain of an Arthropod” (co PIs D. Wiegmann, E. Hebets and W. Gronenberg), Bowling Green portion \$270,000, 2015-2021.

National Geographic Society Grant entitled “Buttress-Bound: Vertebrate-like Navigation by the Nocturnally Active, Neotropical Whip Spider, *Phrynus neoparvulus*” (co PIs D. Wiegmann and E. Hebets), \$18,000, 2014-2015.

NSF Research Grant entitled “The Magnetic Sense of Homing Pigeons and its use in Map Navigation” (co-PI Cordula Mora), \$450,000, 2009-2013.

DARPA Research Grant entitled “UV-Light Sensitivity and Goal Localization Behavior in Homing Pigeons”, \$235,000, 2006-2008.

**RESEARCH SUPPORT (cont.)**

NSF Research Grant entitled "Hippocampal Representation of Space in Birds: An Electrophysiological Analysis", \$410,000, 2000-2007 (carried over as no-cost extension).

NSF SGER Grant entitled "Collaborative Research: Sleep in Nocturnal Bird Migrants: An Interdisciplinary Study" (co-PI Frank Moore of Southern Mississippi), \$20,767, 2003-2006.

NATO Collaborative Linkage Grant entitled "Hippocampus and the Memory Representation of Space", (together with colleagues from Italy and Morocco), \$11,200, 2001-2006.

NSF Research Grant supplement "Research Experience for Undergraduates", 1999, 2000, 2002.

NSF Research Grant entitled "Electrophysiological Survey of Avian Hippocampal Neurons", 1998-2000.

NIH Research Grant entitled "Brain Mechanisms of Spatial Learning", 1996-1998.

Bowling Green State University Research Challenge Grant entitled "Cholinergic Regulation of Learning and Memory Processes", 1996-1999.

NATO Collaborative Research Grant entitled "Navigation and Brain in Homing Pigeons", 1994-2000.

NSF Research Grant supplement "Research Experiences for Undergraduates", 1992, 1993.

NSF Research Grant entitled "The Role of the Hippocampus in the Development of the Homing Pigeon Navigational Map", 1991-1993.

Bowling Green State University Basic Grant, 1990, 1991, 1995.

Bowling Green State University Biomedical Research Grant, 1991.

Bowling Green State University Research Challenge Grant, 1990.

NSF Research Grant entitled "Homing Performance of Pigeons Following Hippocampal Ablation", 1986-1989.

Equipment Grant from the General Electric Corporation, 1980.

Frank M. Chapman Research Award, 1979-1980.

**FELLOWSHIPS**

Alexander von Humboldt Alumni Renewal Fellowship, Ruhr University, Bochum, Germany, 2023.

Visiting Researcher Fellowship, University of Pisa, Italy, 2022

Fulbright Fellowship (Senior Researcher/Lecturer), Seoul National University, Seoul, South Korea, 2021.

Alexander von Humboldt Alumni Renewal Fellowship, Bochum, Germany, 2013.

Fulbright Fellowship (Senior Researcher/Lecturer), Instituto de Biologia y Medicina Experimental, Buenos Aeries, Argentina, 2012.

William Evans Fellowship, Otago University, Dunedin, New Zealand, 2005; 2013.

BBSRC International Research Fellowship, University of Cardiff, Wales, 2005.

Leverhulme Visiting Professor, University of Cardiff, Wales, 2004.

Macquarie University Visiting Research Fellowship, Sydney, Australia, 2004.

Fulbright Fellowship (Senior Lecturer), University of Seville, Spain, 1997.

NIH Post-doctoral Fellowship for proposal entitled "Visual and Cognitive Performance of Hippocampal Ablated Pigeons", 1985-1987.

Italian National Research Council Visiting Research Fellowship, 1985, 1987.

European Science Foundation Fellowship in Brain-Behavior Research, 1984.

Alexander von Humboldt Fellowship from the Federal Republic of Germany, 1982-1984.

E. N. Huyck Preserve Fellowship, Rensselaerville, New York, 1979-1981.

**PROFESSIONAL HONORS AND AWARDS**

International Visiting Professor Award, University of Pisa, Italy, 2022

Awarded Helen C. Seitz Endowed University Professorship, 2018-2021

Elected Fellow of the Animal Behavior Society, 2017

Awarded Title of Distinguished Research Professor, 2008

Awarded Olscamp Research Award, Bowling Green State University, 2001

Nomination, Olscamp Research Award, Bowling Green State University, 2000

Awarded NSF travel grant to attend First International Congress of Neuroethology, 1986.

Awarded position to attend NATO advanced studies institute on "Cognitive Processes and Spatial Orientation in Animals and Man", 1985.

Student fellowship to attend European Science Foundation winter school on "The Ontogeny of Brain Mechanisms and Behavior", 1985.

Ben Smith Travel Award from the State University of New York-Albany, 1978, 1980.

Aaron M. Bagg Student Membership Award to the Wilson Ornithological Society, 1979.

American Ornithologists' Union Student Membership Award, 1978.

## TEACHING EXPERIENCE

Assistant Professor, Associate Professor, Professor, now Distinguished Research Professor, Department of Psychology, Bowling Green State University (1989-present).

Taught the following courses:

- (1) Introductory Psychology
- (2) Introductory Psychology - Honors
- (3) Laboratory Methods in Psychology
- (4) Brain Mechanisms and Behavior with Laboratory Section
- (5) Neurobiology of Comparative Cognition (Graduate)
- (6) Molecular and Cellular Mechanisms of Learning and Memory (Graduate)
- (7) Animal Intelligence (Graduate/Undergraduate)
- (8) Basic Neuroscience and Cognition (Graduate)
- (9) Neuroethology (Graduate/Undergraduate)
- (10) Ornithology (Graduate/Undergraduate)
- (11) Psychology of Space and Time (Graduate/Undergraduate)
- (12) Cognitive Neuroscience
- (13) Behavioral and Neural Genetics

Graduate Faculty, Department of Biological Sciences, Bowling Green State University (1993-present).

Adjunct Faculty, Medical University of Ohio (MUO) (1995-present).

Visiting Professor, Department of Biology, University of Pisa, Italy (2022)

Visiting Professor, Department of Brain and Cognitive Sciences, Seoul National University, Seoul, South Korea (2021). Taught course on "Seminars in Systems Neuroscience II: Development and Change in Cognition Across the Lifespan".

Visiting Professor in Psychology and Zoology, University of Salzburg, Austria (1992, 1996, 1998, 2001, 2003, 2006-2017). Taught graduate/undergraduate courses in Neuroethology, Spatial Behavior in Animals and Man, Comparative Cognition and The Molecular and Cellular Basis of Learning and Memory.

Fulbright Senior Lecturer in Behavioral Neuroscience, Instituto de Biología y Medicina Experimental (IBYME-CONICET) and the University of Buenos Aires, Argentina (2012). Taught course on the neurobiology of spatial memory.

Department of Psychology, University of Alaska-Anchorage (2004). Taught course on “Dementia and Aging: The Hope of Neuroscience”.

La Suerte Biological Field Station, Costa Rica (2001, 2002). Taught course on “Rain Forest Ecology”.

Fulbright Senior Lecturer in Psychology, University of Seville, Spain (1997). Taught course on “Neuroethology”.

Visiting Professor in Psychology, University of Arizona (1996). Taught graduate seminar in “Neuroethology of Spatial Behavior”.

Visiting Professor, Department of Ethology, Ecology and Evolution and Department of Physiology, University of Pisa, Italy (1985, 1988). Taught graduate course in Neuroethology.

Instructor, Department of Psychology, University of Maryland-College Park (1985-1989).

Taught the following courses:

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|---------------------------------|---|
| (1) Introductory Psychology     | (5) Sensation and Perception                      |
| (2) Developmental Biopsychology | (6) Biological Bases of Behavior (Physiol. Psyc.) |
| (3) Conditioning and Learning   | (7) Graduate Psychophysiology                     |
| (4) Memory and Cognition        |   |

Lecturer, University of Maryland-European Division (1984) Taught undergraduate course in Environmental Science.

Graduate Teaching Assistant, Department of Biological Sciences, SUNY-Albany (1976-1981).

Assisted and Lectured for courses in:

- (1) Introductory Biology
- (2) Animal Behavior (also developed associated laboratory)
- (3) Ecology

Additionally, directed student research for Zoology Institute, University of Frankfurt, Frankfurt am Main, Federal Republic of Germany (1982-1983) and Department of Ethology, Ecology and Evolution, University of Pisa, Italy (1984-1987).

### **TEACHING HONORS**

McDonald Hall Professor of the Year, 2001

Nominated for Bowling Green Outstanding Contributor to Graduate Education Award,  
1996

Psychology Department Professor of the Year, 1992

Nominated for Master Teacher Award, Bowling Green State University, 1991, 1992, 2013

Nominated for University of Maryland Excellence in Teaching Award, 1989

### **Ph.D. GRADUATES**

Cheri Budzynski, was Assistant Professor, Heidelberg College, OH, now practicing  
environmental law

Gino Coppola, currently Assistant Professor, Psychology, University of Findlay

Thomas Fuchs, currently Post-doc, University of Pittsburgh

David Gesicki, currently Assistant Professor, Butler County Community College, PA

Meghan Kahn, currently Assistant Professor, Indiana University Southeast

Emlee Kohler, currently Associate Professor, Psychology, Franklin Pierce College, NH

Daniele Nardi, currently Assistant Professor, Ball State University

Lauren Riters, currently Associate Professor, Zoology, Univ of Wisconsin-Madison

Jennifer Siegel, currently Research Assistant Professor, University of Texas-Austin

Rosemary Strasser, currently Associate Professor, Psychology, University of Nebraska-Omaha

### **POST-DOCS**

Tammy Jechura, currently Associate Professor, Albion College, Michigan

Juan Pedro Vargas (Fulbright scholar-Spain), currently Associate Professor, University of  
Seville, Spain

Giovanni Casini, currently Associate Professor, Biology, University of Pisa, Italy

Gerald Hough, currently Associate Professor, Rowan College, New Jersey

Gary Ten Eyck, currently Assistant Professor, University of Idaho

Doug Nitz, currently Professor, UC-San Diego

### **PROFESSIONAL SOCIETIES**

Society for Neuroscience

Animal Behavior Society

American Ornithologists' Union

**JOURNAL EDITORIAL BOARD MEMBER**

MUSiQ (2017-present)  
 Comparative Cognition & Behavior Reviews (2012-present)  
 PLoS ONE (2011-present)  
 Journal of Experimental Biology (2009-present)  
 Psychothema, A Spanish Journal of Psychology (1998-present)  
 Journal of Comparative Psychology (1998-2001)

**REFEREE - REVIEWER (Ad hoc, stopped keeping track in 2005)**

Manuscripts: Animal Behaviour

The Auk	Behavioural Ecology and Sociobiology
Behavioral Neuroscience	Behavioural Brain Research
Behavioral Brain Sciences	
Behavioral Processes	Brain Behavior and Evolution
Cell and Tissue Research	Condor
The European Journal of Neuroscience	
Hippocampus	Ibis
Journal Comparative Physiology A	
Journal of Comparative Neurology	
Journal of Experimental Biology	Journal of Field Ornithology
Journal of Neuroscience	
Learning and Memory	Neuroscience
Neuroscience and Biobehavioral Reviews	
Physiology and Behavior	Proceedings of the Royal Society
Quarterly Journal of Experimental Psychology	

Grants:	National Science Foundation	Italian National Research Council
	National Institutes of Mental Health	
	NATO	Biol. Sciences Research Council, UK
	Wellcome Trust, UK	Italian Space Agency

**BOOK REVIEWS**

Bingman, V. P. (1991). Molecules to Models: Advances in Neuroscience. Ohio Journal of Science 91: 143.

Bingman, V. P. (1992). Orientation in Birds. Quarterly Review of Biology 67: 556.

Bingman, V. P. (1992). Bird Migration. Quarterly Review of Biology 607: 404.

Bingman, V.P. (2014). Nature's Compass. The Mystery of Animal Migration. Quarterly Review of Biology 89: 62-63.

Bingman, V.P. (2014). The Art of Migration. Quarterly Review of Biology 89: 395-396.

**PUBLICATIONS: JOURNAL ARTICLES (All peer reviewed)**

- Bingman, V. P. and K. Able (1979). The sun as a cue in the orientation of the white-throated sparrow, a nocturnal migrant bird. Animal Behavior 27: 621-622.
- Bingman, V. P. (1980) Inland morning flight behavior of nocturnal passerine migrants in eastern New York. Auk 97: 465-472.
- Bingman, V. P. (1980). Novel rape avoidance in the Mallard. Wilson Bulletin 92: 409.
- Bingman, V. P. (1981). Savannah sparrows have a magnetic compass. Animal Behavior 29: 962-963.
- Bingman, V. P., K. Able and P. Kerlinger (1982). Wind drift, compensation and the use of landmarks by nocturnal migrants. Animal Behavior 30: 49-53.
- Able, K., V. P. Bingman, P. Kerlinger and W. Gergits (1982). Field studies of avian nocturnal migratory orientation II. Experimental manipulation of orientation in white throated sparrows (*Zonotrichia albicollis*) released aloft. Animal Behavior 30: 768-773.
- Bingman, V. P. (1983). Importance of earth's magnetism for the sunset orientation of migratory naive savannah sparrows. Monitore Zoologico Italiano 17: 395-400.
- Bingman, V. P. (1983). Magnetic field orientation of savannah sparrows with different first summer experience. Behaviour 87: 43-53.
- Bingman, V. P., P. Bagnoli, P. Ioalé and G. Casini (1984). Homing behavior of pigeons after telencephalic ablations. Brain, Behavior and Evolution 24: 94-106.
- Bingman, V. P., P. Bagnoli, P. Ioalé and G. Casini (1984). Hippocampal ablations and the homing behavior of pigeons. Atti della Accademia Nazionale dei Lincei Vol. LXXXVI: 193-199.
- Bingman, V. P. (1984). Night sky orientation of migratory pied flycatchers raised in different magnetic fields. Behavioral Ecology and Sociobiology 15: 77-80.
- Walther, Y. and V. P. Bingman (1984). Orientierungsverhalten von ziehenden Trauerschnaepfern im Fruejahr in Abhaengigkeit von Wetterfaktoren (Weather dependency of the cage orientation of migratory pied flycatchers in spring). Die Vogelwarte 32: 201-205.
- Kerlinger, P., V. P. Bingman and K. Able (1985). Comparative flight behavior of migrating hawks studied with tracking radar during autumn in central New York. Canadian Journal of Zoology 63: 755-761.
- Bingman, V. P., P. Ioalé, G. Casini and P. Bagnoli (1985). Dorsomedial forebrain ablations and home loft association behavior in homing pigeons. Brain Behavior and Evolution 26: 1-9.



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- Bingman, V. P., G. Casini, P. Ioalé and P. Bagnoli (1986). The avian dorsomedial forebrain: evidence for structural homology and functional similarity with the mammalian hippocampus. Bollettino della Societa' italiana di Biologia sperimentale LXII: 49-50.
- Casini, G., V. P. Bingman and P. Bagnoli (1986). Connections of the pigeon dorsomedial forebrain studied with WGA-HRP and (3H)-proline. Journal of Comparative Neurology 245: 454-470.
- Able, K. and V. P. Bingman (1987). Ontogeny of the orientation and navigation behavior of migratory birds and pigeons. Quarterly Review of Biology 62: 1-29.
- Bingman, V. P., P. Ioalé, G. Casini and P. Bagnoli (1987). Impaired retention of preoperatively acquired spatial reference memory in homing pigeons following hippocampal ablation. Behavioural Brain Research 24: 147-156.
- Bingman, V. P. (1987). Earth's magnetism and the nocturnal migratory orientation of European robins. The Auk 104: 523-525.
- Bingman, V. P. and W. Wiltschko (1988). The importance of earth's magnetism for the sunset orientation of migratory dunnocks (Prunella modularis) Ethology 77: 1-9.
- Bingman, V. P., P. Ioalé, G. Casini and P. Bagnoli (1988). Unimpaired acquisition of spatial reference memory but impaired homing performance in pigeons following hippocampal ablation. Behavioural Brain Research 27: 179-187.
- Bingman, V. P., P. Ioalé, G. Casini and P. Bagnoli (1988). Hippocampal ablated homing pigeons show a persistent impairment in the time taken to return home. Journal of Comparative Physiology, A, 163: 559-563.
- Bingman, V. P. and P. Ioalé (1989). Initial orientation of homing pigeons based on information gathered at familiar release sites remains homeward directed following clock-shift. Behaviour 110: 205-218.
- Bingman, V. P. and J. Mench (1990). Homing behavior of hippocampus and para-hippocampus lesioned pigeons following short-distance releases. Behavioural Brain Research 40: 227-238.
- Bingman, V. P., P. Ioalé, G. Casini and P. Bagnoli (1990). The avian hippocampus: Evidence for a role in the development of the homing pigeon navigational map. Behavioral Neuroscience 104: 906-911.
- Erichsen, J., V. P. Bingman and J. Krebs (1991). The distribution of neuropeptides in the dorsomedial telencephalon of the pigeon (Columba livia): A basis for regional subdivisions. Journal Comparative Neurology 314: 478-492.
- Krebs, J., J. Erichsen and V. P. Bingman (1991). The distribution of neurotransmitters and neurotransmitter-related enzymes in the dorsomedial telecephalon of the pigeon (Columba livia). Journal Comparative Neurology 314: 467-477.

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- Hilgerloh, G. and V. P. Bingman (1992). Radar observations of passerine migration over Frankfurt and Hannover, Germany. Journal fuer Ornithologie 133: 23-31.
- Bingman, V. P. and A. Mackie (1992). Importance of olfaction for homing pigeon navigation in Ohio, USA. Ethology, Ecology and Evolution 4:395-399.
- Bingman, V. P. and W. Hodos. (1992). Visual performance of pigeons following hippocampal lesions. Behavioural Brain Research 51: 203-209
- Bingman, V. P. (1992). The importance of comparative studies and ecological validity for understanding hippocampal structure and cognitive function. Hippocampus 2: 213-220.
- Bingman, V. P. and G. Yates (1992). Hippocampal lesions impair navigational learning in experienced homing pigeons. Behavioral Neuroscience 106: 229-232.
- Riters, L. V. and V. P. Bingman (1994). The NMDA-receptor antagonist MK-801 impairs navigational learning in homing pigeons. Behavioral and Neural Biology 62:50-59.
- Bingman, V. P. (1994). Remembering spatial cognition as a hippocampal functional component (Commentary). Behavioral and Brain Sciences 17:473-474.
- Bingman, V. P., G. Casini, C. Nocjar and T.-J. Jones. (1994). Connections of the piriform cortex of homing pigeons, *Columba livia*, studied with Fast Blue and WGA-HRP. Brain, Behavior and Evolution 43: 206-218.
- Bingman, V. P. and T.-J. Jones (1994). Sun compass based spatial learning impaired in homing pigeons with hippocampal lesions. Journal of Neuroscience, 14: 6687-6694
- Kohler, E. C., W. S. Messer and V. P. Bingman. (1995). Evidence for muscarinic acetylcholine receptor subtypes in the pigeon telencephalon. Journal of Comparative Neurology 362: 271-282.
- Strasser, R. and V. P. Bingman (1996). The relative importance of location and feature cues for homing pigeon (*Columba livia*) goal recognition. Journal of Comparative Psychology 110: 77-87.
- Corey, D. A., L. M. Juárez de Ku, V. P. Bingman and L. A. Meserve (1996). Effects of exposure to polychlorinated biphenyl (PCB) from conception on growth, and development of endocrine, neurochemical, and cognitive measures in 60 day old rats. Growth, Development and Aging 60: 131-143.
- Bingman, V. P. and S. Benvenuti (1996). Olfaction and the homing ability of pigeons in the southeastern United States. Journal of Experimental Zoology 60: 186-192.
- Bingman V. P., A. Gagliardo and P. Ioalé (1996). Hippocampal participation in the sun compass orientation of phase-shifted homing pigeons. Journal of Comparative Physiology A. 179: 695-702.

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- Gagliardo, A., M. Mazzotto and V. P. Bingman (1996). Hippocampal lesion effects on learning strategies in homing pigeons. Proceedings Royal Society of London B **263**: 529-534.
- Jones, M. A. and V. P. Bingman (1996). A neural network analysis of navigational learning in homing pigeons. Forma **11**: 103-114.
- Leutgeb, S., S. Hudson, L. V. Ritters, T. Shimizu and V. P. Bingman (1996). Telencephalic afferents to the caudolateral neostriatum of the pigeon. Brain Research **730**: 173-181.
- Kohler, E. C., L. V. Ritters, L. Chaves and V. P. Bingman (1996). The muscarinic acetylcholine antagonist scopolamine impairs short-distance homing pigeon navigation. Physiology and Behavior **60**: 1057-1061.
- Casini, G., G. Fontanesi, V.P. Bingman, T.-J. Jones, A. Gagliardo and P. Bagnoli (1997). The neuroethology of cognitive maps: contributions from research on the hippocampus and homing pigeon navigation. Archives Italiennes de Biologie **135**: 73-92.
- Gagliardo, A., M. Mazzotto and V.P. Bingman (1997). Piriform cortex ablations block navigational map learning in homing pigeons. Behavioural Brain Research **86**: 143-148.
- Strasser, R. and V.P. Bingman (1997). Goal recognition and the homing pigeon (Columba livia) hippocampal formation. Behavioral Neuroscience **111**: 1245-1256.
- Bingman, V.P., Alyan, S. and Benvenuti, S. (1998). The importance of atmospheric odors for the homing performance of pigeons in the Sonoran desert of the southwestern United States. Journal of Experimental Biology **201**: 755-760.
- Budzynski, C., Strasser, R. and Bingman, V.P. (1998). The effects of zinc sulfate anosmia on homing pigeons, Columbia livia, in a homing and a non-homing experiment. Ethology **104**: 111-118.
- Bingman, V.P., Strasser, R., Baker, C. and Ritters, L.V. (1998). Paired-associate learning is unaffected by combined hippocampal and parahippocampal lesions in homing pigeons. Behavioral Neuroscience **112**: 533-540.
- Benvenuti, S., Bingman, V.P. and Gagliardo, A. (1998). Effect of zinc-sulfate induced anosmia on pigeon homing: a comparison among birds in different regions. Trends in Comparative Biochemistry and Physiology **5**: 221-228.
- Strasser, R., Ioalé, P., Casini, G., Bagnoli, P. and Bingman, V.P. (1998). The homing pigeon hippocampus and the development of landmark navigation. Developmental Psychobiology **33**: 305-315.
- Ritters, L.V. and Bingman, V.P. (1999). The effects of lesions to the caudolateral neostriatum on sun compass based spatial learning in homing pigeons. Behavioural Brain Research **98**: 1-15.

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- Gagliardo, A., Ioalé, P. and Bingman, V.P. (1999). Homing in pigeons: The role of the hippocampal formation in the representation of landmarks used for navigation. Journal of Neuroscience 19: 311-315.
- Budzynski, C. A. and Bingman, V.P. (1999). Time-of-day discriminative learning in homing pigeons, *Columba livia*. Animal Learning and Behavior 27:295-302.
- Pruitt, D. L. and Bingman, V.P. (1999). Reduced growth of intra-and infra-pyramidal mossy fibers is produced by continuous exposure to polychlorinated biphenyl. Toxicology 138:11-17.
- Riters, L.V., Erichsen, J., Krebs, J. and Bingman, V.P. (1999). Neurochemical evidence for at least two regional subdivisions within the homing pigeon (*Columba livia*) caudolateral neostriatum. Journal of Comparative Neurology 412:469-487.
- Bingman, V.P., Able, K.P. and Siegel, J.J. (1999). Hippocampal lesions do not impair the geomagnetic orientation of migratory Savannah sparrows. Journal of Comparative Physiology A. 185: 577-581.
- Strasser, R. and Bingman, V.P. (1999). The effects of hippocampal lesions in homing pigeons on a one-trial food association task. Journal of Comparative Physiology A. 185: 583-590.
- Ioalé, P., Gagliardo, A. and Bingman, V.P. (2000). Further experiments on the relationship between hippocampus and orientation following phase-shift in homing pigeons. Behavioural Brain Research 108: 157-167.
- Ioalé, P., Gagliardo, A. and Bingman, V.P. (2000). Hippocampal participation in navigational map learning in young homing pigeons is dependent on training experience. European Journal of Neuroscience 12: 742-750.
- López, J.C., Bingman, V.P., Rodriguez, F., Gómez, Y. and Salas, C. (2000). Dissociation of place and cue learning by telencephalic ablation in goldfish. Behavioral Neuroscience. 114: 687-699.
- Budzynski, C.A., Dyer, F.C. and Bingman, V.P. (2000). Partial experience with the sun's arc is sufficient for all day sun compass orientation in homing pigeons, *Columba livia*. Journal of Experimental Biology 203: 2341-2348.
- Gagliardo, A., El Agbani, M.A. and Bingman, V.P. (2000). Olfaction and the navigational performance of homing pigeons on the Atlantic coast of Morocco. Italian Journal of Zoology 67: 359-364.
- Siegel, J.J., Nitz, D. and Bingman, V.P. (2000). Hippocampal theta rhythm in awake, freely moving pigeons. Hippocampus 10: 627-631.
- Gagliardo, A., Ioalé P., Odetti, F. and Bingman, V.P. (2001). The ontogeny of the homing pigeon navigational map: evidence for a sensitive period for learning. Proceedings of the Royal Society of London B 268: 197-202.

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- Gagliardo, A., Ialé P., Odetti, F., Bingman, V.P., Siegel, J.J. and Vallortigara, G. (2001). Hippocampus and homing pigeons: left and right hemispheric differences in navigational map learning. European Journal of Neuroscience 13: 1-9.
- Siegel, J.J., Nitz, D. and Bingman, V.P. (2002). Electrophysiological profile of avian hippocampal unit activity: A basis for regional subdivisions. Journal of Comparative Neurology 445: 256-268.
- White, A.R., Strasser, R. and Bingman, V.P. (2002). Hippocampus lesions impair landmark array spatial learning in homing pigeons: A laboratory study. Neurobiology of Learning and Memory 78: 65-78.
- Budzynski, C.A., Gagliardo, A., Ialé, P. and Bingman, V.P. (2002). Participation of the homing pigeon thalamofugal pathway in sun-compass associative learning. European Journal of Neuroscience 15: 197-210.
- Gagliardo, A., Odetti, F., Ialé, P., Bingman, V.P., Tuttle, S. and Vallortigara, G. (2002). Bilateral participation of the hippocampus in familiar landmark navigation by homing pigeons. Behavioural Brain Research 136: 201-209.
- Hough II, G.E., Pang, K.C.H. and Bingman, V.P. (2002). Intrahippocampal connections in the pigeon (*Columba livia*) as revealed by stimulation evoked field potentials. Journal of Comparative Neurology 452: 297-309.
- Bingman, V.P. and Able, K.P. (2002). Maps in birds: representational mechanisms and neural bases. Current Opinion in Neurobiology 12: 745-750.
- Kahn, M.C., Hough II, G.E., Ten Eyck, G. R. and Bingman, V.P. (2003). Internal connectivity of the homing pigeon (*Columba livia*) hippocampal formation: an anterograde and retrograde tracer study. Journal of Comparative Neurology 459: 127-141.
- Bingman, V.P., Hough II, G.E., Kahn, M.C. and Siegel, J.J. (2003). The homing pigeon hippocampus and space: In search of adaptive specialization. Brain, Behavior and Evolution 62: 117-127.
- Strasser, R., Ehrlinger, J. and Bingman, V.P. (2004). Transitive behavior in hippocampal-lesioned homing pigeons. Brain, Behavior and Evolution 63: 181-188.
- Gagliardo, A., Ialé, P., Odetti, F., Kahn, M.C. and Bingman, V.P. (2004). Hippocampal lesions do not disrupt navigational map retention in homing pigeons under conditions when map acquisition is hippocampal dependent. Behavioural Brain Research 153: 35-42.
- Budzynski, C.A. and Bingman, V.P. (2004). Participation of the thalamofugal visual pathway in a coarse pattern discrimination task in an open arena. Behavioural Brain Research 153: 543-556.

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- Gagliardo, A. and Bingman, V.P. (2024). The Avian Olfactory System and Hippocampus: Complementary Roles in the Olfactory and Visual Guidance of Homing Pigeon Navigation. Current Opinion in Neurobiology, 86, 102870. <https://doi.org/10.1016/j.conb.2024.102870>
- Cioccarelli, S., Giunchi, D., Pollonara, E., Casini, G., Bingman, V.P. and Gagliardo, A. (In press). GPS tracking technology and re-visiting the relationship between the avian Wulst and homing pigeon navigation. Behavioural Brain Research, 465, 114971. <https://doi.org/10.1016/j.bbr.2024.114971>
- Sotelo, M.I., Daneri, M.F., Bingman, V.P. and Muzio R.N. (2024). Amphibian spatial cognition, medial pallium and other supporting telencephalic structures. Neuroscience and Biobehavioral Reviews, 163, 105739. <https://doi.org/10.1016/j.neubiorev.2024.105739>
- Cerritelli, G., Cioccarelli, S., Gagliardo, A., Pollonara, E., Bingman, V.P. and Alyan, S. (2024). Flight patterns of monocularly occluded pigeons further reveal a left/right cerebral hemispheric advantage in the visual processing of familiar landscape/landmark features. Ethology Ecology & Evolution, 1-3. <https://doi.org/10.1080/03949370.2024.2358778>



**PUBLICATIONS: BOOK AND PROCEEDINGS CHAPTERS (All edited)**

- Noon, B., V. P. Bingman, and J. Noon (1979) The effects of changes in habitat on northern hardwood forest bird communities. In: Proceedings of Workshop: Management of North Central and Northeastern Forests for Nongame Birds, Minneapolis, Minnesota, pp. 33-48. USDA Forest Service General Technical Report NC-51.
- Bingman, V. P., W. Beck and W. Wiltschko (1985) The ontogeny of migratory orientation: a look at the pied flycatcher (Ficedula hypoleuca). In: Migration: Mechanisms and Adaptive Significance (M. Rankin ed.). Contributions in Marine Science 27 (Supplement): 534-542.
- Bingman, V. P., P. Ialé, G. Casini and P. Bagnoli (1987) Pigeon homing and the avian hippocampal complex: a complementary spatial behavior paradigm. In: Cognitive Processes and Spatial Behavior in Animal and Man (P. Ellen and C. Thinus-Blanc, eds.) pp. 273-283. Nijhof Press, The Netherlands.
- Able, K. and V. P. Bingman (1988) The development of migratory orientation. In: Acta XIX Congressus Internationalis Ornithologici (H. Ouellet, Ed.) pp. 1932-1940. University of Ottawa Press.
- Bingman, V. P. (1988) The avian hippocampus: its role in the neural organization of homing pigeon spatial behavior. In: Acta XIX Congressus Internationalis Ornithologici (H. Ouellet, Ed.) pp. 2075-2082. University of Ottawa Press.
- Bingman, V. P., P. Bagnoli, P. Ialé and G. Casini (1989) Behavioral and anatomical studies of the avian hippocampus. In: The Hippocampus, New Vistas: Vol. 52 Neurology and Neurobiology (V. Chan-Palay and C. Koehler, eds.) pp. 379-394. Liss, New York.
- Bingman, V. P. (1990) Spatial organization in birds. In: Neurobiology of Comparative Cognition (D. Olton and R. Kesner, eds.). pp. 423-447. Erlbaum Press, Hillsdale, New Jersey.
- Bingman, V. P. (1991) The riddle of path finding. In: Fantastic Journeys: The Marvels of Animal Migration. (R. Baker, ed.) pp. 30-37. Weldon Owen, Sydney.
- Bingman, V. P. (1992) Migration, navigation and homing. In: The Encyclopedia of Learning and Memory (L. Squire ed.). pp. 415-418. Macmillan, New York.
- Bingman, V. P. and M. Zucchi (1993) Spatial orientation. In: Neuroscience for Rehabilitation (H. Cohen, ed.). pp. 300-317. Lippincott, Philadelphia.
- Bingman, V. P. (1993) Vision, cognition and the avian hippocampus. In: Bird Vision and Cognition (H.-J. Bischof and P. Zeigler, eds.). pp. 391-408. MIT Press, Cambridge, MA.



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- Bingman, V. P., T.-J. Jones, R. Strasser, A. Gagliardo and P. Ioalé (1995). Homing pigeons, hippocampus and spatial cognition. In: Behavioral Brain Research in Naturalistic and Semi-naturalistic Settings: Possibilities and Perspectives. (E. Alleva, A. Fasolo, H.-P. Lipp, L. Nadel, and L. Riceri, eds.). pp. 207-223. Kluwer Academic Publishers, Dordrecht, Netherlands.
- Bingman, V.P. (1998). Spatial representations and homing pigeon navigation. In: Spatial Representation in Animals. (S. Healy, ed.). pp. 59-85. Oxford University Press, Oxford.
- Bingman, V.P., L.V. Ritters, R. Strasser and A. Gagliardo. (1998). Neuroethology of avian navigation. In: Animal Cognition in Nature (R. Balda, I. Pepperberg and A. Kamil, eds.) pp. 201-226. Academic Press, New York.
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- Bingman, V.P., Budzynski, C.A. and Voggenhuber, A. (2003). Migratory systems as adaptive responses to spatial and temporal variability in orientation stimuli. In: Avian Migration (P. Berthold and E. Gwinner, eds) pp.457-469. Springer, Berlin, Germany.
- Bingman, V. P., Jechura, T., & Kahn, M.C. (2006). Behavioral and neural mechanisms of homing and migration in birds. In: M.F. Brown and R.G. Cook (Eds.), *Animal Spatial Cognition: Comparative, Neural, and Computational Approaches*. [On-line]. Available: [www.pigeon.psy.tufts.edu/asc/bingman/](http://www.pigeon.psy.tufts.edu/asc/bingman/)
- Bingman, V.P., Salas, C. and Rodriguez, F. (2009). Evolution of the Hippocampus. In: Encyclopaedia of Neuroscience (M. Binder, N. Hirokawa, and U. Windhorst, Editors-in-Chief), pp. 1356-1360. Springer-Verlag, Berlin.
- Jamali, M.M., Snyder, B., Williams, J., Kindred, R., John, G.S., Majid, M.W., Ross, J., Frizado, J., Gorsevski, P. and Bingman, V.P. (2011). Remote avian monitoring system for wind turbines. In: Proceedings of the IEEE International Conference on Electro/Information Technology (EIT), pp. 1-5.
- Mirzaei, G., Majid, M.W., Jamali, M.M., Ross, J., Frizado, J., Gorsevski, P.V. and Bingman V.P. (2011). The application of an evolutionary neural network for bat echolocation call recognition. In: Proceedings of the International Joint Conference on Neural Networks (IJCNN), pp. 1106-1111.
- Wiener, J., Shettleworth, S., Bingman, V.P., Cheng, K., Healy, S., Jacobs, L.F., Jeffery, K.J., Mallot, H.A., Menzel R., and Newcombe, N.S. (2011). Animal Navigation-A Synthesis. In: Animal Thinking: Contemporary Issues in Comparative Cognition. Strüngmann Forum Report, vol. 8. pp. 51-76. Cambridge, MA: MIT Press.
- Bingman, V.P. (2011). Making the case for the intelligence of avian navigation. In: Animal Thinking: Contemporary Issues in Comparative Cognition. Strüngmann Forum Report, vol. 8. pp. 39-49. Cambridge, MA: MIT Press.

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- Mirzaei, G., Majid, M.W., Ross, J., Jamali, M.M., Gorsevski, P.V., Frizado, J. and Bingman, V.P. (2012). Implementation of ant clustering algorithm for IR imagery in wind turbine applications. In: 55<sup>th</sup> Midwest Symposium on Circuits and Systems Conference Proceedings, pp 868-871.
- Komatineni, P., N. Nagarajan, M. Wadood, G. Mirzaei, J. Ross, M.M. Jamali, P.V. Gorsevski, J. Frizado and V.P. Bingman (2013). Quantification of bird migration using Doppler weather surveillance radars (NEXRAD). p. 1-4 *In*: 2013 IEEE radar conference (RADAR), Ottawa, Ont., Apr.-May 2013.
- Mirzaei, G., M.M. Jamali, P.V. Gorsevski, J. Frizado and V.P. Bingman (2013). Data fusion of IR and marine radar data. p. 565-568 *In*: 2013 Asilomar Conf. on Signals, Systems & Computers, Pacific Grove, CA, Nov. (2013).
- Wei, L., G. Mirzei, M.W. Majid, M.M. Jamail, J. Ross, P.V. Gorsevski and V.P. Bingman (2014). Birds/bats movement tracking with IR camera for wind farm applications. p. 341-344 *In*: 2014 IEEE Intern. Sympos. on Circuits & Systems (ISCAS), Melbourne, Australia, June 2014.
- Bingman, V.P., F. Rodríguez and C. Salas (2017). The hippocampus in nonmammalian vertebrates. In: Evolution of Nervous Systems, 2<sup>nd</sup> Edition (J. Kaas, ed.) pp. 479-489. Academic Press, Oxford
- Gesicki, D. and V.P. Bingman (2018). Bird Migrations. In: Encyclopedia of Animal Cognition and Behavior (J. Vonk and T. K. Shackelford, eds.). Springer, Heidelberg.  
[https://doi.org/10.1007/978-3-319-47829-6\\_896-1](https://doi.org/10.1007/978-3-319-47829-6_896-1)
- Bingman, V.P. and P. Moore (2017). Properties of the atmosphere in assisting and hindering animal navigation. In: Aeroecology (P. Chilson, P. Frick, W.F. Kelly and J. Liechti, eds.) pp. 119-143. Springer, Heidelberg. DOI 978-3-319-68576-2\_6
- Muzio, R. N., & Bingman, V. P. (2022). Brain and spatial cognition in amphibians: Stem adaptations in the evolution of tetrapod cognition. In: Evolution of Learning and Memory Mechanisms (M. Krause, K. L. Hollis, and M. R. Papini, Eds.). pp. 105-124. Cambridge University Press, Cambridge UK.

**INVITED TALKS**

Arbeitsgruppe Physiologie und Okologie des Verhaltens, Zoologisches Institut, Goethe Universitaet, Frankfurt am Main, Federal Republic of Germany, 1980.

Research and Development Lab, General Electric Corporation, Schenectady, New York, 1981.

Section of Neurobiology and Behavior, State University of New York-Stony Brook, New York, 1981.

Institut fuer Verhaltensphysiologie, Universitaet Bielefeld, Bielefeld, Federal Republic of Germany, 1983.

Max-Plank-Institut fuer Verhaltenphysiologie, Vogelwarte, Radolfzell, Federal Republic of Germany, 1983.

Zoologisches Institute, Goethe Universitaet, Frankfurt am Main, Federal Republic of Germany, 1983

Instituto di Biologia Generale, Universita di Pisa, Pisa, Italy, 1983.

Instituto di Fisiologia, Universita di Pisa, Pisa, Italy, 1985.

Psychologisches Institut, Ruhr Universitaet, Bochum, Federal Republic of Germany, 1983, 1985.

XIX International Ornithological Congress, Ottawa, Canada, 1986.

Department of Psychology, University of Toronto, Toronto, Canada, 1986.

Rockefeller University Field Research Center, Millbrook, New York, 1986.

Department of Psychology, Johns Hopkins University, Baltimore, Maryland, 1987.

Department of Physiology, Downstate Medical Center, Brooklyn, New York, 1987.

Department of Biology, University of Southern Mississippi, Hattiesberg, Mississippi, 1987.

International Conference on "Bird Vision and Cognition", Bielefeld, Federal Republic of Germany, 1989.

European Neuroscience Association Symposium on "Comparative Aspects of Hippocampal Circuitry and Behavior", Torino, Italy, 1989.

Department of Ecology and Systematics, State University of New York - Stony Brook, Stony Brook, New York, 1989.

American Psychological Society Symposium "Multiple Spatial Memory Systems," Dallas, Texas, 1990.

Department of Psychology, University of Massachusetts, Amherst, Massachusetts, 1990.

Department of Biology, Bowling Green State University, Bowling Green, Ohio, 1991.

Department of Psychology, Miami University, Oxford, Ohio, 1991.

Department of Psychology, University of Western Ontario, London, Canada, 1992.

School of Pharmacy, University of Toledo, Toledo, Ohio, 1992.

Department of Psychology, University of York, England, 1992.

Department of Zoology, Oxford University, England, 1992.

Zoology Institute, University of Frankfurt, Germany, 1992.

Department of Psychology, Salzburg University, Austria, 1992.

Sub Department of Animal Behavior, University of Cambridge, England, 1993.

XXI International Ornithological Congress (Two), Vienna, Austria, 1994.

NATO Advanced Study Institute on “Behavioural Brain Research in Naturalistic and Seminaturlistic Settings: Possibilities and Perspectives”, Maratea, Italy, 1994.

Department of Neuroscience, Oberlin College, Oberlin, Ohio, 1994.

Institute of Animal Behavior, Rutgers University, Newark, New Jersey, 1994.

Department of Zoology, Ohio State University, Columbus, Ohio, 1995.

Department of Biopsychology, University of Seville, Spain, 1995.

European COMETT Seminar on “Event-related Neuro-imaging”, Salzburg, Austria, 1995.

Association for the Study of Animal Behaviour Conference on “Spatial Representation in Animals”, London, England, 1995.

Symposium on Animal Cognition, Northern Arizona University, Flagstaff, Arizona, 1996.

Department of Psychology, University of Arizona, Tucson, Arizona, 1996.

Department of Biology, Northern Arizona University, Flagstaff, Arizona, 1996.

Department of Psychology, University of Geneva, Switzerland, 1997.

Department of Psychology, University of Bochum, Germany, 1997.

Midwest Regional Animal Behavior Society Conference Symposium on “The Neuroethology of Sensory Systems”, Columbus, Ohio, 1997.

Department of Biological Sciences, State University of New York, Albany, 1998

Life Sciences Department, Defiance College, Defiance, Ohio, 1998

Life Sciences Department, Muskingum College, New Concord, Ohio, 1998

Midwestern Psychological Association Meeting Symposium on "Current Issues on the Neurobiology of Learning and Memory: The Hippocampus and Beyond", Chicago, IL, 1998

Department of Biology, Heidelberg College, Tiffin, Ohio, 1998

Department of Biology, Eastern Michigan University, Ypsilanti, Michigan, 1998

Department of Biology, Case Western Reserve University, Cleveland, Ohio, 1999

Center for Integrative Neuroscience, University of Illinois-Chicago, Chicago, Illinois, 1999

Smithsonian Migratory Bird Institute, Washington, D.C., 1999

Cleveland Area Audubon Society, Cleveland, Ohio, 2000

Seminar on Imaging Cognition and Emotion, University of Salzburg, Austria, 2000

XXVII International Congress of Psychology, Symposium on "Comparative Studies of Spatial Cognition and Hippocampus", Stockholm, Sweden, 2000

Kalamazoo College, Kalamazoo, Michigan, 2001

II International Seminar on Consciousness in Animals, University of Salzburg, Austria, 2001

Symposium on Avian Migration, Konstanz, Germany, 2001

Symposium on the Neurobiology of Animal Orientation and Navigation, Society for Integrative and Comparative Biology, Anaheim, California, 2002

Symposium on Animal Cognition, American Association for the Advancement of Science, Boston, Massachusetts, 2002

Department of Psychology, Ohio State University, Columbus, Ohio, 2002

Department of Zoology and Behavioral Biology Program, University of Nebraska, Lincoln, Nebraska, 2002

Department of Biology, Texas AM University, College Station, Texas, 2002

Department of Natural Sciences, University of Michigan-Dearborn, Dearborn, Michigan, 2002

Karger Symposium on Comparative Cognitive Neuroscience, J.B. Johnston Society, Orlando, Florida, 2002

Department of Psychology, University of Michigan, Ann Arbor, Michigan, 2002

Spring Hippocampal Research Conference, Symposium on Adaptation and Evolution, Grand Cayman, 2004

Festschrift for William Hodos and Harvey Karten, University of Maryland-College Park, 2004

Department of Psychology, Macquarie University, Sydney, Australia, 2004

Symposium on Comparative Hippocampal Organization, Tokyo, Japan, 2004

Departments of Psychology and Optometry, Cardiff University, Wales, 2004

Zangwill Lecture, Department of Psychology, Cambridge University, England, 2004

Institute of Neuroecology, University of Newcastle, England, 2004

Department of Zoology, Oxford University, England, 2004

Presidential Symposium on Spatial Cognition, Eastern Psychological Association Annual Meeting, Boston, Massachusetts, 2005

Department of Zoology, University of Bristol, England, 2005

Department of Psychology, University College London, England, 2005

Department of Psychology, Auckland University, New Zealand, 2005

Department of Psychology, Otago University, New Zealand, 2005

Department of Psychology, University of Western Ontario, Canada, 2005

University of Tennessee Health Sciences Center, Memphis, Tennessee, 2006

Department of Biology, University of Ferrara, Italy, 2006

Symposium on The Challenges of Intercontinental Migration: Eastern and Western Perspectives (with Thomas Fuchs and Frank Moore). IV North American Ornithological Congress. Vera Cruz, Mexico, 2006.

Department of Zoology, Delhi University, Delhi, India, 2007

Cedar Point Biological Station-Ogallala, Nebraska, University of Nebraska, 2007

Symposium on Comparative Hippocampal Function, Congress for the Society of Neuroethology, Vancouver, Canada, 2007

Department of Psychology and Spatial Intelligence Learning Center, Temple University, Philadelphia, PA, 2007

Workshop on Hippocampus and Navigation, Gulbenkian Institute of Science, Oeiras, Portugal, 2008

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Neuroscience Training Program, University of Wisconsin-Madison, 2008

Department of Biology, Hope College, Holland, MI, 2009

Department of Psychology and Neuroscience Training Program, University of Saskatchewan, Saskatoon, Canada, 2010

Navigation Working Group Discussion Chair, International Workshop on Migration (MIGRATE), Konstanz, Germany, 2010

Graduate Program in Neuroscience, Ruhr University, Bochum, Germany, 2010

Department of Biology, Siena Heights University, Adrian, MI, 2010

Strüngmann Forum on Animal Thinking, Frankfurt, Germany, 2010

Symposium on Navigation, Meeting of the Cognitive Science Society, Boston, MA, 2011

Department of Psychology, University of Nebraska-Lincoln, Lincoln, NE, 2011

Darwin Day Speaker, Toledo Atheists Society, Toledo, OH, 2012

Humboldt Kolleg 2012 Challenges and Frontiers of Physics and Chemistry to Modern Biology, Habana, Cuba, 2012

Department of Biological Sciences, University of Kentucky, Lexington, KY, 2012

Neuroscience Institute, Georgia State University, Atlanta, GA, 2012

Instituto de Biología y Medicina Experimental (IBYME-CONICET), Buenos Aires, Argentina, 2012

Plenary Lecture, IV Congreso Internacional de Investigación y Práctica Profesional en Psicología, Buenos Aires, Argentina, 2012

Center for Systems Neuroscience, Hannover, Germany, 2013

Institute for Cognitive Neuroscience, Ruhr University, Bochum, Germany, 2013

Department of Psychology, University of Otago, Dunedin, New Zealand, 2013

Center for Mind/Brain Sciences, University of Trento, Rovereto, Italy, 2013

Functional Architecture of Memory Conference, Ruhr University, Bochum, Germany, 2014

XVII Meeting of the International Society for Comparative Psychology, Bogotá, Colombia, 2014.

XXVII International Congress of the Spanish Society for Comparative Psychology, Seville, Spain, 2015.

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Department of Psychology, University of Seville, Spain, 2015

Animal Behavior, Training and Health Seminar, The Animal Behavior Center, Sylvania, OH, 2015

Department of Biological Sciences, University of Pittsburgh, Pittsburgh, PA, 2015

Keynote Presentation, Fall Meeting of the Comparative Cognition Society at the Society for Neuroscience Conference, Chicago, IL, 2015

Department of Biological Sciences, University of Cincinnati, Cincinnati, OH, 2016

First iNAV Navigation Conference, Bad Gastein, Austria, 2016

28<sup>th</sup> Annual Karger Workshop in Evolutionary Neuroscience, “The Hippocampus: Questions of Homology”, San Diego, CA, 2016

Department of Psychology, Indiana University-Purdue University Fort Wayne, Fort Wayne IN, 2017

Neuroscience Community “Data-Blitz”, University of Arizona, Tucson, AZ, 2017

Department of Psychology/Behavioral and Systems Neuroscience, Rutgers University, New Brunswick, NJ, 2017

Workshop on Space, Memory and Evolution: The Comparative View on the Hippocampus. Ruhr Universität, Bochum, Germany, 2017

Sensorium 2017 (Symposium on Sensory Biology and Ecology), University of Cincinnati, Cincinnati, OH, 2017

Symposium: Convergencias Transculturales del Caribe y Centroamerica, Bowling Green State University, Bowling Green, OH, 2018

Department of Psychology and College of Arts and Sciences, Drake University, Des Moines, Iowa, 2018

Keynote Speaker, International Symposium on Music Cognition, Universitatea de Vest, Timisoara, Romania, 2018

Keynote Speaker, National Conference on Art and Education, Gheorghe Dima Music Academy, Cluj-Napoca, Romania, 2018

Institute of Medical Pathology, Vienna, Austria, 2019

Symposium on Brain and Spatial Cognition in Amphibians: Primary Adaptations and the Evolution of Cognition in Tetrapods. 17<sup>th</sup> Meeting of the Argentina Society for Behavioral Sciences, Posadas, Argentina, 2019



International Plenary Speaker, 17<sup>th</sup> Meeting of the Argentina Society for Behavioral Sciences, Posadas, Argentina, 2019

Symposium on Integrative Comparative Cognition: Avian Spatial Navigation and the Hippocampus: Can Diversity in Behavioral Mechanisms Guide Searches for a Genetics of Cognition?, Society for Integrative and Comparative Biology Meeting 2020, Austin, Texas, 2020

Department of Brain and Cognitive Science, Seoul National University, South Korea (Zoom), 2020

Department of Biological Sciences, Korean Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea, 2021

Dialogues on Ethology and Behavioural Ecology Seminar Series, University of Pisa, Pisa, Italy, 2022

XXXII International Conference of the Spanish Society for Comparative Psychology, Almeria, Spain, 2022

Department of Neural Basis of Learning, Ruhr University, Bochum, Germany, 2023

Conference on Bird Brains and Cognition, Institute of Cognitive Neuroscience, Ruhr University, Bochum, Germany, 2023

15<sup>th</sup> International Congress of Neuroethology, Berlin, Germany, 2024

Ohio Sea Grant Science and Outdoor Writers Conference, Put-in-Bay, OH, 2024.

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**PRESENTATIONS AT SCIENTIFIC MEETINGS (See also invited talks)**

The morning flight behavior of nocturnal passerine migrants in eastern New York. American Ornithologists' Union, Madison, Wisconsin, 1978.

Ontogeny of orientation in hand-reared Savannah sparrows. Mini-symposium on Orientation and Navigation, Rockefeller University, Millbrook, New York, 1980.

Wind drift compensation and the use of landmarks by nocturnal migrants (with K. Able and P. Kerlinger). American Ornithologists' Union, Fort Collins, Colorado, 1980.

Early experience as a determinant of the migratory orientation behavior of savannah sparrows. Animal Behavior Society, Knoxville, Tennessee, 1981.

Earth's magnetism and the sunset orientation behavior of hand-reared and wild-caught migratory savannah sparrows. XVIII International Ornithological Congress, Moscow, U.S.S.R., 1982.

Zur Zugorientierung der Heckenbraunelle zur Zeit des Sonnenunterganges (Sunset orientation behavior of migratory hedge sparrows). Deutsche Ornithologen Gesellschaft, Erlangen, Federal Republic of Germany, 1983.

Dorsomedial cortex and the homing behavior of pigeons. Italian Ethological Society, Torino, Italy, 1983.

The avian hippocampal-parahippocampal complex, pigeon homing and cognitive maps. European Science Foundation Winter School on The Ontogeny of Brain Mechanisms and Behaviour. Zuoz, Switzerland, 1985.

Homing performance of hippocampal ablated pigeons with special reference to deficits following pre- and post-ablation training from a familiar site. NATO Advanced Study Institute on Cognitive Processes and Spatial Orientation in Animal and Man, Aix en Provence, France, 1985.

Neurobiological aspects of pigeon homing behavior (with a large group of others). International Ethological Congress, Toulouse, France, 1985.

The avian hippocampus: its role in the neural organization of homing pigeon spatial behavior. XIX International Ornithological Congress, Ottawa, Canada, 1986.

The pigeon hippocampus and homing behavior. First International Congress of Neuroethology. Tokyo, Japan, 1986.

The avian hippocampus and insights into its role in pigeon homing behavior. International Ethological Congress. Madison, Wisconsin, 1987.

Spatial behavior after hippocampal lesions in homing pigeons. Society for Neuroscience Meeting. New Orleans, Louisiana, 1987.

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- The immunohistochemistry and cytoarchitecture of the avian hippocampus (with J. Krebs and J. Erichsen). Society for Neuroscience Meeting. New Orleans, Louisiana, 1987.
- Anticholinergic treatment mimics the effect of hippocampal ablation on the homing behavior of pigeons (with L. Chaves, J. Erichsen and J. Krebs). Society for Neuroscience Meeting. Phoenix, Arizona, 1989.
- Hippocampal lesions impair navigational map development in homing pigeons (with P. Ioalé, G. Casini and P. Bagnoli). Society for Neuroscience Meeting, St. Louis, Missouri, 1990.
- Behavioral and anatomical evidence for a homing pigeon olfactory map in Ohio. (with A. Mackie and G. Casini). Animal Behavior Society Meeting, Wilmington, North Carolina, 1991.
- Connections of the homing pigeon olfactory cortex studied with WGA-HRP and fast blue. (with G. Casini, C. Nocjar and T.-J. Jones). Society for Neuroscience Meeting, New Orleans, Louisiana, 1991.
- The role of the hippocampus in avian navigational learning. Society for Experimental Biology, Canterbury, England, 1993.
- The NMDA-receptor antagonist MK-801 blocks navigational learning in homing pigeons (with L. V. Riters). Society of Neuroscience Meeting, Washington, D.C., 1993.
- Binding of (<sup>3</sup>H)(R) - quinuclidinyl benzilate and pirenzepine to pigeon brain membranes (with E. C. Kohler and W. S. Messer). Society for Neuroscience Meeting, Washington, D.C., 1993.
- Hippocampal lesions impair sun compass learning in homing pigeons (with T.-J. Jones). Society for Neuroscience Meeting, Washington, D.C., 1993.
- Influence of pre-and/or post-weaning polychlorinated biphenyl on basal forebrain and hippocampal choline acetyltransferase activity in 60 day old rats (with a large group of others). Society for Neuroscience Meeting, Washington, C.D., 1993.
- Homing in pigeons: Understanding the relationship between brain and spatial cognition. XVI Winter Animal Behavior Conference, Jackson Hole, Wyoming, 1994.
- Critical importance of the hippocampus for local navigational learning in young homing pigeons. (with P. Ioalé, G. Casini, P. Bagnoli and R. Strasser). Society for Neuroscience Meeting, Miami, Florida, 1994.
- Muscarinic acetylcholine receptor subtypes in the pigeon telencephalon: Distribution of pirenzepine-sensitive and AF-DX 116-sensitive sites (with E. C. Kohler and W. S. Messer). Society for Neuroscience Meeting, Miami, Florida, 1994.
- Orientation of American toad larvae (Bufo americanus) under sun and overcast: insights into the ontogeny of Y-axis orientation (with Hidetaka Mizohata). Midwest Regional Animal Behavior Society Meeting, Oxford, Ohio, 1995.

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- A radar analysis of nocturnal bird migration in the Lake Erie region (with Windi Wojdak), Animal Behavior Society Meeting, Lincoln, Nebraska, 1995.
- Afferent connections and cognitive function of the pigeon neostriatum caudolaterale (with S. Leutgeb, S. Hudson, L. Ritters and T. Shimizu). Society for Neuroscience Meeting, San Diego, California, 1995.
- Distribution of neurotransmitters, related enzymes, and neuropeptides within the pigeon caudolateral neostriatum (with L. Ritters, J.T. Erichsen and J.R. Krebs). Society for Neuroscience Meeting, Washington, D.C., 1996.
- Age-related changes in cell proliferation in homing pigeons (with V. Simon, R. Strasser and D.A. Holtzman). Society for Neuroscience Meeting, Washington, D.C., 1996.
- The homing pigeon hippocampal formation and learning strategies for goal recognition (with R. Strasser). Society for Neuroscience Meeting, Washington, D.C., 1996.
- Homing pigeon visual relational learning is unaffected by hippocampal lesions (with C. Baker, L. Ritters and R. Strasser). Society for Neuroscience Meeting, Washington, D.C., 1996.
- Initial orientation of hippocampal ablated pigeons subjected to clock-shift treatment (with A. Gagliardo and P. Ioalé). Royal Institute of Navigation meeting on Orientation and Navigation-Birds, Humans and Other Animals, Oxford, England, 1997.
- Effects of zinc sulfate anosmia on the homing performance of pigeons in different climatic regions of the United States: evidence for global use of atmospheric odors (with S. Benvenuti). Royal Institute of Navigation meeting on Orientation and Navigation-Birds, Humans and Other Animals, Oxford, England, 1997.
- Polychlorinated biphenyls produce selective loss of hippocampal mossy fibers and impair maze navigation (with D. Pruitt). Society for Neuroscience Meeting, New Orleans, Louisiana, 1997.
- Comparative analysis of basal forebrain neurons containing GABA, ChAT, and calcium binding proteins in homing pigeons and rats (with L. McConkey, C. Budzynski and K. Pang). Society for Neuroscience Meeting, New Orleans, Louisiana, 1997.
- Homing pigeon spatial relational learning is affected by hippocampal lesions (with A. White and R. Strasser). Society for Neuroscience Meeting, New Orleans, Louisiana, 1997.
- Time of day discrimination learning and hippocampal lesions in homing pigeons *Columba livia* (with C. Budzynski). Society for Neuroscience Meeting, Los Angeles, California, 1998.
- Transitivity learning is not impaired in homing pigeons with lesions to the hippocampal formation (with R. Strasser and J. Ehrlinger). Society for Neuroscience Meeting, Los Angeles, California, 1998.
- Hippocampus and the migratory orientation of savannah sparrows. Winter Meeting on the Neurobiology of Learning and Memory, Park City, Utah, 1999.

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- Hippocampal unit firing properties in homing pigeons (with J.J. Siegel and D. Nitz). Society for Neuroscience Meeting, Miami, Florida, 1999.
- The effect of wulst and ectostriatum lesions on sun compass learning and pattern discrimination (C.A. Budzynski). Society for Neuroscience Meeting, New Orleans, Louisiana, 2000.
- This is what a pigeon brain looks like while navigating home: expression of an immediate-early gene protein during homing (with A.N. Bowers, C.A. Budzynski and T. Shimizu). Society for Neuroscience Meeting, New Orleans, Louisiana, 2000.
- Unihemispheric sleep in homing pigeons? An EEG analysis of the wulst and hippocampus r during sleep (with S.A. Bombich, T. Fuchs and J.J. Siegel). Society for Neuroscience Meeting, New Orleans, Louisiana, 2000.
- Electrophysiological profile of avian hippocampal units: a comparative basis for regional subdivisions (with J.J. Siegel and D. Nitz). Society for Neuroscience Meeting, New Orleans, Louisiana, 2000.
- Left and right hemispheric differences in navigational map learning in homing pigeons. (with J.J. Siegel, A. Gagliardo, P. Ioalé, F. Odetti, and G. Vallortigara). Society for Neuroscience Meeting, San Diego, California, 2001.
- Connectivity y among homing pigeon hippocampal subregions as determined by electrophysiological stimulation/recording techniques. (with G. Hough and K. Pang). Society for Neuroscience Meeting, San Diego, California, 2001.
- Intrinsic connections of the homing pigeon hippocampus: An anterograde pathway tracing study. (with G.R. Ten Eyck and M.C. Kahn). Society for Neuroscience Meeting, San Diego, California, 2001.
- Radial glia and neurogenesis-like labeling in the hippocampus of adult homing pigeons. (with M.C. Kahn and G.R. Ten Eyck). Society for Neuroscience Meeting, San Diego, California, 2001.
- Lateralization of landmark spatial learning strategies in the hippocampus of homing pigeons. (with M.C. Kahn). Society for Neuroscience Meeting, Orlando, Florida, 2002.
- Space-specific single-unit activity in the homing pigeon hippocampus: A first order analysis. (with J.J. Siegel, G Hough and D. Nitz). Society for Neuroscience Meeting, Orlando, Florida, 2002.
- Neural responses of homing pigeon hippocampal neurons: goals, paths and locations. (with G Hough). Society for Neuroscience, New Orleans, Louisiana, 2003.
- Lateralized response properties of hippocampal neurons recorded from freely behaving pigeons. (with J Siegel and D Nitz). Society for Neuroscience, San Diego, California, 2004.

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- Single unit recording in the hippocampus of homing pigeons moving through an open field setting. (with T Jechura, J Siegel and M Kahn). Society for Neuroscience, San Diego, California, 2004.
- Hemispheric differences in the homing pigeon hippocampus: Single unit data from an open field environment (with M Kahn, J Siegel and T Jechura). Society for Neuroscience, Washington, D.C., 2005.
- Effects of light cue rotation on spatial response profiles of individual neurons in the homing pigeon hippocampus (with G Hough). Society for Neuroscience, Washington, D.C., 2005.
- Brain-behavior adaptation to naturally occurring sleep loss in the Swainson's thrush (*Catharus ustulatus*) (with T Fuchs, A Haney, T Jechura and F R Moore). Society for Neuroscience, Washington, D.C., 2005.
- The avian hippocampus: Space or spatial salience? (with D. Nardi). Annual International Conference on Comparative Cognition, Melbourne, FL, 2006.
- Pigeon encoding of a goal location: The relative importance of boundary geometry and the vertical dimension of slope. (with D. Nardi). Annual International Conference on Comparative Cognition, Melbourne, FL, 2008.
- Migratory behavior as a factor influencing the evolution of avian brain organization. (with G. Bernroider, J. D. Ross, R. Fuchs, H. Winkler and B. Helm). Royal Institute of Navigation Conference: Orientation & Navigation Birds, Humans and other Animals, Reading, United Kingdom, 2008.
- Detection of terrestrial magnetism in migrating birds: Is it a question of vision? (with S. Migalski, T. Meydan and J. T. Erichsen). International Magnetism Conference, Madrid, Spain, 2008.
- Collision course? Assessing wind development impact on migrant birds along the Lake Erie coast. (with J. Ross). 69<sup>th</sup> Midwest Fish and Wildlife Conference, Columbus, Ohio, 2008.
- Feature-based encoding of goal quality is unaffected by hippocampal lesions in homing pigeons. (with J. Spencer). Society for Neuroscience, Chicago, IL, 2009.
- The avian hippocampus and representing the quality of goal locations. (with M. Kahn). Society for Neuroscience, Chicago, IL, 2009.
- Magnetic vision. (with J. Erichsen (speaker), S. Migalski and T. Meydan). European Conference on Magnetic Sensors & Actuators, Bodrum, Turkey, 2010.
- Can a homing pigeon's head movements serve as a measure of its behavioural response to changes in a magnetic field? (with T. Meydan, J. Erichsen and S. Migalski). European Conference on Magnetic Sensors & Actuators, Bodrum, Turkey, 2010.
- Spatial scale and the challenges of goal navigation in homing pigeons. 32<sup>nd</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2010.

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- The avian septal area and spatial working memory (with Ryan Peterson). Society for Neuroscience, San Diego, CA, 2010.
- Geomagnetic maps in birds: always present, sometimes present or illusion? 33<sup>rd</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2011.
- Do homing pigeons (*Columba livia*) use the Earth's magnetic field to determine their position during homing? (with C. Mora). Royal Institute of Navigation Conference: Orientation & Navigation Birds, Humans and other Animals, Reading, United Kingdom, 2011.
- On landmarks and landscapes in avian navigation. 34<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2012.
- Detection of magnetic field intensity slope direction by homing pigeons in a "virtual magnetic map" during a novel spatial conditioning task (with C. Mora). International Congress of Neuroethology, College Park, MD, 2012.
- Conditioned detection of magnetic field intensity slope direction by homing pigeons in a novel "virtual magnetic map" task (with C. Mora). Society for Neuroscience, New Orleans, LA, 2012.
- Detection of magnetic field inclination by homing pigeons in a novel conditioning paradigm (with M. Acerbi and C. Mora). Society for Neuroscience, New Orleans, LA, 2012.
- Detection of magnetic field intensity cues by homing pigeons (*Columba livia*) in a virtual magnetic map environment (with C. Mora). Royal Institute of Navigation (RIN) 13-Bionav. London, UK, 2013.
- Conditioned discrimination of magnetic field inclination by homing pigeons (*Columba livia*) in a spatial orientation task (with M. Acerbi and C. Mora). Royal Institute of Navigation (RIN) 13-Bionav. London, UK, 2013.
- Nocturnal navigation in a complex environment by whip spiders (Order Amblypygi) (with D. Wiegmann, E. Hebets, E. Gering and J. Graving). Animal Behaviour Society, Boulder CO, 2013.
- Geometric orientation in amphibians: Evolutionary conserved spatial navigation? (with Rubén Muzio and Maria Inés Sotelo). XXV Congreso Internacional de la Sociedad Española de Psicología Comparada. San Sebastián, Spain, 2013.
- Mixed migration strategies in the eastern lark sparrow (with J. D. Ross, E. S. Bridge and M. J. Rozmarynowycz). 133<sup>rd</sup> Meeting of the American Ornithologists Union, Chicago, IL, 2013.
- Distribution of neurotransmitter receptors in the pigeon hippocampal formation: A further basis for comparison with mammals (with C. Herold, M. Sauvage, N. Palomero-Gallagher, K. Zilles and O. Güntürkün). Society for Neuroscience, San Diego, CA, 2013.

Data fusion of IR and marine radar data (with many others). 2013 Asilomar Conference on Signals, Systems and Computers. Pacific Grove, CA, 2013.

Regularized logistic regression based classification for infrared images (with many others). Asilomar Conference on Signals, Systems and Computers. Pacific Grove, CA, 2013.

Update on magnetic intensity/inclination discrimination in homing pigeons: brain, behavior and relevance for migration (with Cordula Mora). 36<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2014.

Multimodal sensory reliance in the nocturnal homing of the amblypygid *Phrynus pseudoparvulus* (with E. A. Hebets, and a large group of others). 51<sup>st</sup> Animal Behavior Conference, Princeton, NJ, 2014.

Data fusion of acoustic, IR camera and marine radar. (with M. M. Jamali, G. Mirzaee, P. Gorsevski and J. R. Ross). 2014 Bird Strike Committee USA, Atlanta, GA, 2014.

Navigation in amphibians: Geometry and local feature cues (with R.N. Muzio, I. Sotelo). XVII Meeting of the International Society for Comparative Psychology, Bogotá, Colombia, 2014.

Spatial memory deficits in old homing pigeons (*Columba livia*): A novel experimental model for age-related cognitive decline (with V. Coppola). Society for Neuroscience, Washington, D.C., 2014.

New insights into avian brain organization and its relevance for spatial cognition. 37<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2015.

Further evidence for cognitive decline in old homing pigeons (*Columba livia*): Spatial-feature reference memory impairment (with M.E. Flaim, S.N. Carey and V. Coppola). Meeting of the Eastern Psychological Association, Philadelphia, PA, 2015.

Use of slope as a navigational beacon in amphibians. (with M.I. Sotelo and R.N. Muzio). XXVII International Congress of the Spanish Society for Comparative Psychology, Seville, Spain, 2015.

Amphibian spatial memory: Long-term retention of geometric and slope navigational information in the terrestrial toad *Rhinella arenarum* (with M.I. Sotelo and R.N. Muzio). XXVII International Congress of the Spanish Society for Comparative Psychology, Seville, Spain, 2015.

Gross anatomical correlates of age-related spatial-cognitive decline in homing pigeons (*Columba livia*) (with V.J. Coppola, A.J. Schreiber and N. Kanyok). 2015 Society for Neuroscience Conference, Chicago, IL, 2015.

The neuroecology of migration: The tale of the lark sparrow. 38<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2016.



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- Neural processing of magnetic intensity and inclination cues by lesioned homing pigeons (*Columba livia*) in a magnetic conditioning paradigm (with Cordula Mora and Merissa Acerbi). Royal Institute of Navigation-RIN 16. London, United Kingdom, 2016.
- Nocturnal navigation by amblypygids (Class Arachnida, Order Amblypygi) (with Dan Wiegmann). Royal Institute of Navigation-RIN 16. London, United Kingdom, 2016.
- Avian forebrain processing of magnetic intensity and inclination information: Hippocampus, Wulst and an unexpected dissociation. (with Merissa Acerbi and Cordula Mora). 39<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2017.
- Differential wall-length discrimination in homing pigeons (*Columba livia*) (with Brittany Sizemore). 89<sup>th</sup> Annual Meeting of the Midwestern Psychological Association, Chicago, IL, 2017.
- Topographical influences on migratory orientation (with David Gesicki). 135<sup>th</sup> Stated Meeting of the American Ornithological Society, East Lansing, MI, 2017
- Importance of the antenniform legs, but not vision, for navigation by the neotropical whip spider, *Paraphrynus laevifrons* (with J. Graving, E. Hebets and D. Wiegmann). Meeting of the American Arachnological Society, Querétaro, Mexico, 2017.
- Reconstructing the evolution of the hippocampus: Structure and function of the amphibian medial pallium (with Inés Sotelo and Rubén Muzio). 40<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2018.
- Multi-sensory guidance of whip spider homing behavior (with Patrick Casto, Eileen Hebets and Dan Wiegmann). 2018 American Arachnological Society Meeting, Eastern Michigan University, Ypsilanti, MI, 2018.
- Spatial navigation in amphibians: Hippocampal encoding of space based on conspecific vocalizations (with Inés Sotelo and Rubén Muzio). 2018 Congress for Neuroethology, Brisbane, Australia, 2018.
- Tactile cues facilitate shelter discrimination in Amblypygi (Arthropoda: Arachnida) (with Kaylyn AS Flanigan and Dan Wiegmann). 2019 meeting of the Society for Integrative and Comparative Biology, Tampa, FL, 2019.
- Evidence for distal-allocentric representation of refuge location in whip spiders (Arachnida: Amblypygi). (with Patrick Casto, Eileen Hebets and Dan Wiegmann). 2019 meeting of the Society for Integrative and Comparative Biology, Tampa, FL, 2019.
- Shelter fidelity and homing mechanisms in *Phrynus pseudoparvulus* (Whip Spiders) (with Meghan E. Moore and Dan Wiegmann). 2019 meeting of the Society for Integrative and Comparative Biology, Tampa, FL, 2019.
- Cluster N activity in nocturnal birds: Circadian control or facultative regulation? (with Madeleine Brodbeck, S. Yuan and Scott MacDougall-Shackleton). 2019 meeting of the Society for Integrative and Comparative Biology, Tampa, FL, 2019.

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Birds over Lake Erie: Topographical awareness during migration. 41<sup>st</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2019.

Cluster N activity in migratory white-throated sparrows: Circadian control or facultative regulation? (with Madeleine Brodbeck and Scott MacDougall-Shackleton). 10<sup>th</sup> RIN Conference on Animal Navigation. Royal Holloway College, United Kingdom, 2019.

Conditional temporal discrimination in pigeons (with Danielle Beckley, Kelsey Pogatzetz, Martin Acerbo and Olga Lazareva). Annual International Conference on Comparative Cognition, Melbourne, FL, 2019.

Migratory songbirds and the Earth's magnetic field: What activates Cluster N? (with Madeleine Brodbeck, S. Yuan and Scott MacDougall-Shackleton). Annual International Conference on Comparative Cognition, Melbourne, FL, 2019.

The sensory control of navigation in Amblypygids (with Dan Wiegmann and others). Behavior 2019 (56<sup>th</sup> Annual Conference of the Animal Behavior Society and 36<sup>th</sup> International Ethological Conference), Chicago, IL, 2019.

Insights into the sensory control of whip spider cognition (with Dan Wiegmann and Kaylyn Flanigan). 42<sup>nd</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2020

The avian hippocampus and homing pigeon navigation: Perceptual or memory space? 43<sup>rd</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2022.

A preliminary investigation of the cholinergic hypothesis of cognitive aging in birds (with Vincent Coppola and Daniele Nardi). Ohio Academy of Sciences Annual Meeting, Findlay, OH, 2022.

Whip spiders prefer geometric to feature information for goal-directed navigation (with many others). Midwestern Psychological Association Annual Conference, Chicago, IL, 2022.

Wind direction predicts homing success in the nocturnal amblypygid *Phrynus marginemaculatus* (with Patrick Casto, Eileen Hebets and Daniel Wiegmann). American Arachnology Society Meeting, Ithaca, NY, 2023.

Cluster N activity in migrating white-throated sparrows: Circadian control or facultative regulation? (with Madeleine Brodbeck and Scott MacDougall-Shackleton). 44<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2023.

Whip spider olfactory-tactile multisensory integration does not generalize to the intramodal integration of two olfactory stimuli (with many others). Sensorium 2023

Aging, cognitive decline and hippocampus in homing pigeons. 45<sup>th</sup> Winter Animal Behavior Conference, Steamboat Springs, CO, 2024.

