

Curriculum Vitae of Tyson Lee Hedrick

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Research and Professional Experience

1995 – 1996: Undergraduate Research Assistant, Brown University
Supervisor: Prof. George E. Goslow, Jr.
1996 – 1997: Undergraduate Research Assistant, Brown University
Supervisor: Prof. Sharon M. Swartz
1999 – 2004: Graduate Student Researcher, Harvard University
Supervisor: Prof. Andrew A. Biewener
Thesis Committee: G.V. Lauder; F.A. Jenkins, Jr.; B.W. Tobalske
2004 – 2007: Postdoctoral Researcher, University of Washington
Supervisor: Prof. Thomas L. Daniel
2007 – Present: Assistant Professor, Department of Biology, University of North Carolina at Chapel Hill

Honors and Awards

1999: Harvard University Certificate of Distinction in Teaching
2001: NSF Pre-Doctoral Fellowship – Honorable Mention
2002: Harvard University Certificate of Distinction in Teaching
2003: Harvard University Certificate of Distinction in Teaching
2004: NIH Ruth L. Kirschstein NRSA (declined)
2004: NSF Postdoctoral Research Fellowship in Biological Informatics
2007: NSF Research Starter Grant, Experimental and Computational Investigation of Closed Loop Flight Control in the Hawkmoth *Manduca Sexta*

Education

1993 – 1997: Brown University, Rhode Island
B.S. in Biology, Honors
Honors thesis: The Biomechanics of Head-Butting in Bighorn Sheep
1999 – 2004: Harvard University, Massachusetts
Ph.D. (2004) in Biology
Dissertation: Aerodynamics, biomechanics and neuromuscular control of avian flight

Teaching Experience

1997 (Fall): Undergraduate Teaching Assistant, Comparative Vertebrate Biology
1999 (Fall): Teaching Fellow, Structure and Function of the Vertebrates
2000 (Fall): Teaching Fellow, Structure and Function of the Vertebrates
2001 (Fall): Teaching Fellow, Structure and Function of the Vertebrates
2003 (Fall): Teaching Fellow, Structure and Function of the Vertebrates
2007 (Fall): Mathematical and Computational Models in Biology (BIOL 452)
2008 (Fall): Seminar on the Evolution of Animal Flight (BIOL 490)
2009 (Spring): Lab in Comparative Physiology (BIOL 290L)
2009 (Spring): Comparative Physiology (BIOL 451)

Professional Societies

Society for Integrative and Comparative Biology
American Physiological Society
Society of Experimental Biology
Sigma Xi
American Institute for Aeronautics and Astronautics

Professional Service

2008: Co-organizer of the Society for Integrative and Comparative Biology Southeast Regional meeting (Clemson, SC)
2009: Co-organizer of the Society for Integrative and Comparative Biology Southeast Regional meeting (Chapel Hill, NC)
2008 – present: Chair of the Best Student Paper committee, Society for Integrative and Comparative Biomechanics, Division of Comparative Biomechanics

University and Departmental Service

2008 – present: Co-chair of UNC Dept. of Biology Computer Committee
2008 – present: Member of the UNC Curriculum in Applied Sciences and Engineering Planning Committee

Ad Hoc Referee

Biology Letters
Journal of Aircraft
Journal of Experimental Biology
Journal of Experimental Zoology
Journal of Field Ornithology
Journal of Insect Science
Journal of Neuroscience Methods
Journal of Neurophysiology
Journal of Neuroscience
Journal of Theoretical Biology
Journal of the Royal Society: Interface
National Science Foundation – Directorate for Biological Sciences
PLoS Computational Biology
Proceedings of the Royal Society: Biological Sciences
Royal Society Interface
Science
Zoology

Publications

Hedrick, T. L., Tobalske, B. W. and Biewener, A. A. (2002). Estimates of circulation and gait change based on a three-dimensional kinematic analysis of flight in cockatiels (*Nymphicus hollandicus*) and ringed turtle-doves (*Streptopelia risoria*). *J. Exp. Biol.* **205**, 1389-1409.
Hedrick, T. L., Tobalske, B. W. and Biewener, A. A. (2003). How cockatiels (*Nymphicus hollandicus*) modulate pectoralis power output across flight speeds. *J. Exp. Biol.* **206**, 1363-1378.
Tobalske, B. W., Hedrick, T. L. and Biewener, A. A. (2003). Wing kinematics of avian flight across speeds. *J. Avian Biol.* **34**, 177-184.
Tobalske, B. W., Hedrick, T. L., Dial, K. P. and Biewener, A. A. (2003). Comparative power curves in bird flight. *Nature* **421**, 363-366.

- Usherwood, J. R., Hedrick, T. L. and Biewener, A. A. (2003). The aerodynamics of avian take-off from direct pressure measurements in Canada geese (*Branta canadensis*). *J. Exp. Biol.* **206**, 4051-4056.
- Hedrick, T. L., Usherwood, J. R. and Biewener, A. A. (2004). Wing inertia and whole body acceleration: an analysis of instantaneous aerodynamic force production in cockatiels (*Nymphicus hollandicus*) flying across a range of speeds. *J. Exp. Biol.* **207**, 1689-1702.
- Usherwood, J. R., Hedrick, T. L., McGowan, C.R., Biewener, A. A. (2005). Dynamic pressure maps for wings and tails of pigeons in slow, flapping flight, and their energetic implications. *J. Exp. Biol.*, **208**, 355-369
- Soman, A. R., Hedrick, T. L., McGowan, C.R., Biewener, A. A. (2005). Regional patterns of pectoralis fascicle strain in the pigeon (*Columba livia*) during level flight. *J. Exp. Biol.* **208**, 771-786
- Hedrick, T. L. and Daniel, T. L. (2006). Inverse problems in the flight control of the hawkmoth *Manduca sexta*. *J. Exp. Biol.* **208**, 3114-3130.
- Hedrick, T. L. and Biewener, A. A. (2007). Low speed maneuvering flight of the rose-breasted cockatoo (*Eolophus roseicapillus*) I. Kinematic and neuromuscular control of turning. *J. Exp. Biol.* **210**, 1897-1911.
- Hedrick, T. L., Usherwood, J. R. and Biewener, A. A. (2007). Low speed maneuvering flight of the rose-breasted cockatoo (*Eolophus roseicapillus*) II. Inertial and aerodynamic reorientation. *J. Exp. Biol.* **210**, 1912-1924.
- Tobalske, B. W., Warrick, D. R., Clark, C. J., Powers, D. R., Hedrick, T. L., Hyder, G. A. and Biewener, A. A. (2007). Three-dimensional kinematics of hummingbird flight. *J. Exp. Biol.* **210**, 2368-2382.
- Riskin, D. K., Willis, D. J., Iriarte-Díaz, J., Hedrick, T. L., Kostandov, M., Chen, J., Laidlaw, D. H., Breuer, K. S. and Swartz, S. M. (2008). Quantifying the complexity of bat wing kinematics. *J. of Theor. Biol.* **254**, 604-615.
- Hedrick, T. L. (2008). Software techniques for two- and three-dimensional kinematic measurements of biological and biomimetic systems. *Bioinspiration & Biomimetics* **3**, 034001.
- Kingsolver, J. G. and Hedrick, T. L. (2008). Biomechanical Acclimation: Flying Cold. *Current Biology* **18**, R876.
- Hedrick, T. L., Cheng, B. and Deng, X. (2009). Wingbeat time and the scaling of passive, rotational damping in flapping flight. *Science* **5924**, 252-255.

Published Conference Proceedings

- Nishikawa, K., Biewener, A. A., Aerts, P., Ahn, A. N., Chiel, H. J., Daley, M. A., Daniel, T. L., Full, R. J., Hale, M. E., Hedrick, T. L. et al. (2007). Neuromechanics: an integrative approach for understanding motor control. *Integr. Comp. Biol.*, icm024.
- Hedrick, T. L. and Biewener, A. A. (2007). Experimental Study of Low Speed Turning Flight in Cockatoos and Cockatiels. *AIAA Paper 2007-0044*.
- Zheng, L., Wang, X., Khan, A., Vallance, R. R., Mittal, R. and Hedrick, T. L. (2009). A Combined Experimental-Numerical Study of the Role of Wing Flexibility in Insect Flight. *AIAA Paper 2009-382*.

Invited Seminars and Symposia

- Dept. of Ecology and Evolutionary Biology, Brown University, Nov. 2002
- Dept. of Biology, University of North Carolina (Chapel Hill), Feb. 22, 2005
- Dept. of Biology, Wake Forest University, Sept. 12, 2007
- Dept. of Biology, University of North Carolina (Chapel Hill), Sept. 18, 2007
- Dept. of Mechanical and Aerospace Engineering, The George Washington University, Feb. 12, 2008
- 4th International Symposium on Adaptive Motion of Animals & Machines, Case Western Reserve University, Jun. 4, 2008
- International Congress of Entomology, Insect Flight Symposium, July 7, 2008
- Lab of Ornithology seminar series, Cornell University, Nov. 2008

Machines and Organisms seminar series, Cornell University, Nov. 2008
Dept. of Mechanical Engineering, The Johns Hopkins University, Nov. 2008

Invited Course Lectures

- “Vertebrate flight” in Structure and Physiology of the Vertebrates (OEB 102, Harvard University), Nov. 2003
“Muscle and Motility” in Biological Design: Structural Architecture of Organisms (BIO 040, Brown University), Oct. 2005; Oct. 2006
“Vorticity” in Biological Design: Structural Architecture of Organisms (BIO 040, Brown University), Oct. 2006

Selected Conference Presentations

- 2001: International Congress of Vertebrate Morphology
Hedrick, T. L., Tobalske, B. W. and Biewener, A. A. (2001). 3D kinematic analysis of flight over a range of speeds in ring-necked doves and cockatiels. *J. Morph.* **248**, 239.
- 2002: American Physiological Society
Hedrick, T. L., Tobalske, B. W. and Biewener, A. A. (2002). Modulation of power output in cockatiels. *Physiologist*, **45**, 347.
- 2003: Society of Experimental Biology
Hedrick, T. L., Tobalske, B. W. and Biewener, A. A. (2003). Inertial power transfer in avian flapping flight over a range of speeds: muscles, wings and aerodynamics.
- 2004: Society for Integrative and Comparative Biology
Hedrick, T. L. (2004). Low-speed maneuvering flight in the rose-breasted cockatoo. *SICB final program and abstracts*, pp. 122.
- 2005: Society of Experimental Biology Symposium: Biomechanics and Aerodynamics of Unsteady Locomotion
Hedrick, T. L. (2005). Asymmetric flapping: Turning flight in cockatoos and cockatiels.
- 2006: Society for Integrative and Comparative Biology Symposium: Biomechanics and Neuromuscular Control
Hedrick, T. L. and Daniel, T. L. (2006). Control and Dynamics of the flight of the hawkmoth.
- 2007: Society for Integrative and Comparative Biology
Hedrick, T. L. and Daniel, T. L. (2007). Creating a flap: Different ways to wing it.
- 2008: Society for Integrative and Comparative Biology
Hedrick, T. L. (2008), Perturbation Compensation in Hovering Flight
- 2009: Society for Integrative and Comparative Biology
Hedrick, T. L., Deng, X., Cheng, B. (2009) Scaling of passive damping and maneuverability in flying animals