

Donald R. Powers, Ph.D.

Professor Emeritus of Biology, George Fox University · dpowerslab.com · Updated October 2026

Contact

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U.S. Citizen

Education

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|-----------|--|
| 1975–1979 | Biola College, La Mirada, California
Bachelor of Science (Biology), 1979. |
| 1979–1982 | San Diego State University, San Diego, California
Master of Science (Biology), 1982
Advisor: George W. Cox, Ph.D.
Thesis: Effects of variation in food quality on the breeding territoriality of the male Anna's hummingbird. |
| 1984–1989 | University of California, Davis, California
Doctor of Philosophy (Physiological Ecology), 1989
Advisor: Wesley W. Weathers, Ph.D.
Dissertation research: Energy and water relations of hummingbirds. |

Academic/research positions held (after 1985)

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| 1985–1988 | Research Assistant
Department of Avian Sciences
University of California, Davis. |
| 1989 | Instructor
Sierra Community College
Course assignments: Introductory Biology. |

1989–93	Assistant Professor George Fox College
1994–98	Associate Professor George Fox University
1999–2023	Professor George Fox University
2023–	Professor Emeritus George Fox University

Professional activities

CURRENT SOCIETY MEMBERSHIPS

1984–	Cooper Ornithological Society
1985–	American Ornithologist's Union
1987–	Society for Integrative and Comparative Biology
1989–	Wilson Ornithological Society
1989–	Sigma Xi
2016–	American Physiological Society

GRANTS, AWARDS, AND FELLOWSHIPS RECEIVED (AFTER 1989)

1991	National Geographic Society Grant-in-Aid of Research.
1992	George Fox College Faculty Development Grant
1994	Holman Professorship (George Fox College)
1994	George Fox College Faculty Development Grant
1995	George Fox University Faculty Development Grant
1997–2002	Holman Professorship (George Fox University)
1998	Murdock Charitable Trust Research Grant
2000	George Fox University Faculty Development Grant
2001	George Fox University Faculty Development Grant
2001	Holman Research Grant
2001	George Fox University Faculty Research Award
2001	Elective member of the American Ornithologists' Union
2002	Holman Research Grant

2003	Holman Research Grant
2004	Holman Research Grant
2006	George Fox University Faculty Development Grant
2008	George Fox University Faculty Development Grant
2008	Holman Research Grant
2009	George Fox University Faculty Development Grant
2010	George Fox University Faculty Development Grant
2011	George Fox University Faculty Development Grant
2011–2016	NASA Climate & Biological Change Grant
2013	George Fox University Faculty Development Grant
2014	Holman Professorship, George Fox University
2016	George Fox University Faculty Development Grant
2018	Egg Farmers of Canada Research Grant
2023	Egg Farmers of Canada Research Grant

GRANT APPLICATIONS (UNSUCCESSFUL)

1992	National Science Foundation (RUI)
1994	National Science Foundation (RUI)
1994	National Geographic Society Grant-in-Aid of Research
1996	Mazamas Research Grant
1997	National Geographic Society Grant-in-Aid of Research
2000	Mazamas Research Grant
2004	National Science Foundation
2005–07	Murdock Life Sciences
2014	National Geographic Society Grant-in-Aid of Research

SERVICE TO THE COLLEGE/UNIVERSITY/SOCIETIES (AFTER 1985)

1987–	Manuscript referee for <i>The Condor</i> , journal of the Cooper Ornithological Society.
1988–	Manuscript referee for <i>The Wilson Bulletin</i> , journal of the Wilson Ornithological Society.
1989–	Manuscript referee for <i>Physiological Zoology</i> , The University of Chicago Press.
1989–1993	Faculty Development Committee, George Fox College (chairman, 1991–3).
1990–1994	Chairman, Animal Care Committee, George Fox College.

1991–1994	Human Subjects Committee, George Fox College.
1991–1996	Treasurer, Cooper Ornithological Society.
1992–2007	Murdock Undergraduate Collaborative Research Program Committee (Oregon Health Sciences University, Physiology Department)
1992–1994	Master of Arts in Teaching Admissions Committee.
1992–	Manuscript referee for <i>Journal of Comparative Physiology</i>
1993–1995	American Heart Association, Oregon Affiliate, Research Grant Evaluation Panel.
1993–1996	American Heart Association, Yamhill County Chapter, Board of Directors
1994	Teaching Evaluation Task Force
1994	Student Assessment Task Force
1994	Convener, round table discussion on “Hummingbird Biology” XXI International Ornithological Congress, Vienna, Austria
1996–	Manuscript referee for <i>Southwestern Naturalist</i> .
1998–2000	Elected member, Board of Directors, Cooper Ornithological Society
1998–2009	Chair, Department of Biology and Chemistry, George Fox
1998–	Manuscript referee for <i>Biotropica</i> .
1999–	Y2K Task Force
2000–	Faculty Development Committee, George Fox University
2001–2012	Academic Standing Committee, George Fox University (Chair 2004–)
2001	Lead Faculty, Oregon Technology in Education Network, George Fox
2001–2009	Richter Scholar Committee, George Fox University
2002	Organizer of symposium “Linking physiology, morphology, and ecology in nectar-feeding birds” North American Ornithological Conference
2003	Faculty Technology Mentor search committee
2004	Chaired IT Director search committee
2005	Cooper Ornithological Society Painton Award Committee
2008	Strategic Planning: Resources that empower (committee)
2008–	Manuscript referee <i>Journal of Experimental Biology</i>
2010–	Manuscript referee <i>Comparative Physiology & Biochemistry</i>
2011–	Manuscript referee <i>Journals of the Royal Society</i>
2013–2016	Richter Scholar Committee

2014–2016	Chair, Biology & Chemistry Research Funding Task Force
2017–2023	Faculty Senate
2021–2023	Chair, Richter Scholar Committee

Scholarly activity

RESEARCH/MENTORSHIP ACTIVITY (OUTSIDE GFU)

1996	Oregon Health Science University – Visiting Researcher
2012–2019	Stony Brook University, NY – Ph.D. External Committee Member
2017	Swiss Federal Institute for Forest, Snow, and Landscape Research – Visiting Researcher
2018	Swiss Federal Institute for Forest, Snow, and Landscape Research – Visiting Researcher
2019–Present	Guelph University – MSc External Committee Member
2026–	University of Montana – MS External Committee Member

PUBLICATIONS

Authors in *italics* are former undergraduate students.

- Elting, R. L.*, M. Z. Anwar, D. R. Powers, B. Cheng, H. Luo, and B. W. Tobalske. 2026. Tail flaring during agonism in hummingbirds. *Journal of Experimental Biology* 229:jeb253064. doi.org/10.1242/jeb.253064
- Elting, R. L.*, A. Shankar, C. H. Graham, H. Beck, A. Rico-Guevara, and D. R. Powers. 2026. Foraging plasticity and physiological adaptations enable hummingbirds to subsist on dilute nectars. *Functional Ecology* 40:1475–1490. doi.org/10.1111/1365-2435.70308
- Alexandre, N. M., F. G. Romero, S. G. English, E. Grames, F. Garzon-Agudelo, K. Epperly, T. Barnes, D. R. Powers, A. *E. Smith*, Z. Migicovsky, L. Stein, S. Akalu, H. Sridhar, G. Montross, E. Collins, and A. Rico-Guevara. 2025. Supplemental feeding as a driver of population expansion and morphological change in Anna's hummingbirds. *Global Change Biology* 31:e70237. doi.org/10.1111/gcb.70237
- Crandell, K. E., D. R. Powers, and B. W. Tobalske. 2025. The role of plumage and heat dissipation areas in thermoregulation in doves. *Journal of Experimental Biology* 228:248200. doi.org/10.1242/jeb.248200
- Hong, G. A. T., B. W. Tobalske, N. van Staaveren, E. M. Leishman, T. Widowski, D. R. Powers, and A. Harlander-Mataushek. 2025. Hen-durance training — effects of an exercise regimen on laying hen muscle architecture and fracture prevalence. *Royal Society Open Science* 12:241191. doi.org/10.1098/rsos.241191
- Hong, G. A. T., B. W. Tobalske, N. van Staaveren, E. M. Leishman, T. Widowski, D. R. Powers, and A. Harlander-Mataushek. 2024. A wing-assisted incline running exercise regime during rearing increases initial flight velocity during descent in adult white- and brown-feathered laying hens. *Poultry Science* 103:103375. doi.org/10.1016/j.psj.2023.103375

- Hong, G. A. T., B. W. Tobalske, N. van Staaveren, E. M. Leishman, T. Widowski, D. R. Powers, and A. Harlander-Mataushek. 2023. Reduction of wing area affects estimated stress in the primary flight muscles of chickens. *Royal Society Open Science* 10:230817. doi.org/10.1098/rsos.230817
- Eberts, E. R., G. J. Tattersall, P. J. Auger, E. G. Strauss, M. Curley, M. I. Morado, D. R. Powers, N. M. Camacho, B. W. Tobalske, S. M. Wethington, and A. Shankar. 2023. Free-living hummingbirds avoid using torpor while nesting. *Journal of Thermal Biology* 112:103391. doi.org/10.1016/j.jtherbio.2022.103391
- Garant, R., B. W. Tobalske, N. BenSassi, N. van Staaveren, D. Tulpan, T. Widowski, D. R. Powers, and A. Harlander-Mataushek. 2023. Does wing use and disuse cause behavioural and musculoskeletal changes in domestic fowl (*Gallus gallus domesticus*)? *Royal Society Open Science* 10:220809. doi.org/10.1098/rsos.220809
- Garant, R., B. W. Tobalske, N. BenSassi, N. van Staaveren, D. Tulpan, T. Widowski, D. R. Powers, and A. Harlander-Mataushek. 2022. Effects of clipping of flight feathers on resource use in *Gallus gallus domesticus*. *Royal Society Open Science* 9:211561. doi.org/10.1098/rsos.211561
- Shankar, A., I. N. H. Cisneros, S. Thompson, C. H. Graham, and D. R. Powers. 2022. A heterothermic spectrum in hummingbirds. *Journal of Experimental Biology* 225:jeb243208. doi.org/10.1242/jeb.243208
- León, B. M., B. W. Tobalske, N. BenSassi, R. Garant, D. R. Powers, and A. Harlander-Mataushek. 2021. Domestic egg-laying hens, *Gallus gallus domesticus*, do not modulate flapping flight performance in response to wing condition. *Royal Society Open Science* 8:210196. doi.org/10.1098/rsos.210196
- Yap, K. N., D. R. Powers, M. L. Vermette, O. H-I Tsai, and T. D. Williams. 2021. Physiological adjustments to high foraging effort negatively affect fecundity but not final reproductive output in captive zebra finches. *Journal of Experimental Biology*. doi.org/10.1242/jeb.235820
- Yap, K. N., D. R. Powers, M. L. Vermette, O. H-I Tsai, and T. D. Williams. 2021. Sex-specific energy management strategies in response to training for increased foraging effort prior to reproduction. *Journal of Experimental Biology*. doi.org/10.1242/jeb.235846
- Tell, L. A., J. A. Hazlehurst, R. R. Bandivadkar, J. C. Brown, A. R. Spence, D. R. Powers, D. W. Agnew, L. W. Woods, and A. Engilis Jr. 2021. Hummingbird (Family: Trochilidae) Research: Welfare-Conscious Study Techniques for Live Hummingbirds and Processing of Hummingbird Specimens. *Museum of Texas Tech University Special Publications* No. 76. mwfb.ucdavis.edu/sites/g/files/dgvnsk1266/files/inline-files/Hummingbird%20Manual%202021.pdf
- Shankar, A., R. J. Schroeder, S. M. Wethington, C. H. Graham, and D. R. Powers. 2020. Hummingbird torpor in context: duration, more than temperature, is the key to energy savings. *Journal of Avian Biology* 2020:e02305. doi.org/10.1111/jav.02305
- Shankar, A., C. H. Graham, J. R. Canepa, S. M. Wethington, and D. R. Powers. 2019. Hummingbirds budget energy flexibly in response to changing resources. *Functional Ecology* 33:1904–1916. doi.org/10.1111/1365-2435.13404
- Shankar, A., D. R. Powers, L. M. Dávalos, and C. H. Graham. 2019. The allometry of daily energy expenditure in hummingbirds: an energy budget approach. *Journal of Animal Ecology* 89:1254–1261. doi.org/10.1111/1365-2656.13185

- Powers, S. D., M. R. McTernan, D. R. Powers, and R. A. Anderson. 2018. Energetic consequences for a northern, range-edge lizard population. *Copeia* 106:468–476. doi.org/10.1643/cp-17-713
- Groom, D. J. E., M. C. B. Toledo, D. R. Powers, B. W. Tobalske, and K. C. Welch Jr. 2018. Integrating morphology and kinematics in the scaling of hummingbird hovering metabolic rate and efficiency. *Proceedings of the Royal Society B* 285:20172011. doi.org/10.1098/rspb.2017.2011
- Friesen, C. R., D. R. Powers, and R. T. Mason. 2017. Using whole-group metabolic rate to assess the energetics of courtship in red-sided garter snakes. *Animal Behaviour* 130:177–185. doi.org/10.1016/j.anbehav.2017.06.020
- Powers, D. R., K. Langland, S. M. Wethington, S. D. Powers, C. H. Graham, and B. W. Tobalske. 2017. Hovering in the heat: effects of ambient temperature on thermal balance in foraging hummingbirds. *Royal Society Open Science* 4:171056. doi.org/10.1098/rsos.171056
- Cheng, B., B. W. Tobalske, D. R. Powers, T. L. Hedrick, S. M. Wethington, and X. Deng. 2016. Flight mechanics and control of escape manoeuvres in hummingbirds. I. Flight kinematics. *Journal of Experimental Biology* 219:3518–3531. doi.org/10.1242/jeb.137539
- Cheng, B., B. W. Tobalske, D. R. Powers, T. L. Hedrick, Y. Wang, S. M. Wethington, G. T.-C. Chiu, and X. Deng. 2016. Flight mechanics and control of escape manoeuvres in hummingbirds. II. Aerodynamic force production, flight control and performance limitations. *Journal of Experimental Biology* 219:3532–3543. doi.org/10.1242/jeb.137570
- Graham, C. H., S. R. Rupp, D. R. Powers, P. Beck, M. C. W. Lim, A. Shankar, T. Cormier, S. Goetz, and S. M. Wethington. 2016. Winter conditions influence biological response of migrating hummingbirds. *Ecosphere* 7:e01470. doi.org/10.1002/ecs2.1470
- Song, J., H. Luo, B. W. Tobalske, D. R. Powers, and T. L. Hedrick. 2016. Three-dimensional simulation for fast forward flight of a calliope hummingbird. *Royal Society Open Science* 3:160230. doi.org/10.1098/rsos.160230
- Powers, D. R., B. W. Tobalske, J. K. Wilson, H. A. Woods, and K. R. Corder. 2015. Heat dissipation during hovering and forward flight in hummingbirds. *Royal Society Open Science* 2:150598. doi.org/10.1098/rsos.150598
- Friesen, C. R., D. R. Powers, P. E. Copenhaver, and R. T. Mason. 2015. Size dependence in non-sperm ejaculate production is reflected in daily energy expenditure and resting metabolic rate. *Journal of Experimental Biology* 218:1410–1418. doi.org/10.1242/jeb.120402
- Supp, S. R., F. A. La Sorte, T. A. Cormier, M. C. W. Lim, D. R. Powers, S. M. Wethington, S. Goetz, and C. H. Graham. 2015. Citizen-science data provides new insight into annual and seasonal variation in migration patterns. *Ecosphere* 6:15. doi.org/10.1890/es14-00290.1
- Powers, D. R., B. W. Tobalske, P. Getsinger, S. M. Wethington, and S. D. Powers. 2012. Respiratory water loss during hovering and forward flight in hummingbirds. *Comparative Biochemistry & Physiology Part A* 161:279–285. doi.org/10.1016/j.cbpa.2011.11.008
- Powers, D. R., J. A. Van Hook, E. A. Sandlin, and T. J. McWhorter. 2010. An examination of arthropod foraging in a southeastern Arizona hummingbird guild. *Wilson Journal of Ornithology* 122:494–502. doi.org/10.1676/09-179.1

- Tobalske, B. W., A. A. Biewener, D. R. Warrick, T. L. Hedrick, and D. R. Powers. 2010. Effects of flight speed upon muscle activity in hummingbirds. *Journal of Experimental Biology* 213:2515–2523. doi.org/10.1242/jeb.043844
- Warrick, D. R., B. W. Tobalske, and D. R. Powers. 2009. Lift production in the hovering hummingbird. *Proceedings of the Royal Society B* 276:3747–3752. doi.org/10.1098/rspb.2009.1003
- Casotti, G., T. Waldron, G. Misquith, D. Powers, and L. Slusher. 2007. Expression and localization of an aquaporin-1 homologue in the avian kidney and lower intestinal tract. *Comparative Biochemistry and Physiology A* 147:355–362. doi.org/10.1016/j.cbpa.2007.01.005
- Tobalske, B. W., D. R. Warrick, C. J. Clark, D. R. Powers, T. L. Hedrick, G. A. Hyder, and A. A. Biewener. 2007. Three-dimensional kinematics of hummingbird flight. *Journal of Experimental Biology* 210:2368–2382. doi.org/10.1242/jeb.005686
- Warrick, D. R., B. W. Tobalske, D. R. Powers, and M. H. Dickinson. 2007. The aerodynamics of hummingbird flight. *American Institute of Aeronautics and Astronautics* 41:1–5. doi.org/10.2514/6.2007-41
- Warrick, D., B. W. Tobalske, and D. R. Powers. 2005. Aerodynamics of the hovering hummingbird. *Nature* 435:1094–1097. doi.org/10.1038/nature03647
- Powers, D. R. 2004. The impact of social interactions on torpor use in hummingbirds. In *Life in the Cold: Evolution, Mechanisms, Adaptation, and Application*, Twelfth International Hibernation Symposium (B. M. Barnes and H. V. Carey, eds.). *Biological Papers of the University of Alaska*, no. 27. Institute of Arctic Biology, University of Alaska, Fairbanks.
- Tobalske, B. W., D. L. Altshuler, and D. R. Powers. 2004. Take-off mechanics in hummingbirds (Trochilidae). *Journal of Experimental Biology* 207:1345–1352. doi.org/10.1242/jeb.00889
- McWhorter, T. J., D. R. Powers, and C. Martinez del Rio. 2003. Are hummingbirds facultatively ammonotelic? Nitrogen excretion and requirements as a function of body size. *Physiological and Biochemical Zoology* 76:731–743. doi.org/10.1086/376917
- Powers, D. R., A. R. Brown, and J. A. Van Hook. 2003. The influence of normal daytime fat deposition on laboratory measurements of torpor use in territorial vs. non-territorial hummingbirds. *Physiological and Biochemical Zoology* 76:389–397. doi.org/10.1086/374286
- Ficken, M. S., K. S. Rusch, S. J. Taylor, and D. R. Powers. 2002. Reproductive behavior and communication in Blue-throated Hummingbirds. *Wilson Bulletin* 114:197–209. doi.org/10.1676/0043-5643(2002)114%5B0197:rbacib%5D2.0.co;2
- Ficken, M. S., K. S. Rusch, S. J. Taylor, and D. R. Powers. 2000. Blue-throated Hummingbird song: a pinnacle of non-oscine vocalizations. *Auk* 117:120–128. doi.org/10.1093/auk/117.1.120
- Powers, D. R., and S. M. Wethington. 1999. Broad-billed Hummingbird (*Cynanthus latirostris*). *Birds of the World*, No. 430. doi.org/10.2173/bow.brbhum.01.2
- Powers, D. R. 1999. Family Trochilidae (Hummingbirds). Pp. 536–680 in J. del Hoyo, A. Elliott, and J. Sargatal, eds., *Handbook of the Birds of the World*, Vol. 5: Barn Owls to Hummingbirds. Lynx Edicions, Barcelona.
- Powers, D. R. 1996. Magnificent Hummingbird (*Eugenes fulgens*). *Birds of North America*. doi.org/10.2173/bna.221

- Powers, D. R., and *T. Conley*. 1994. Metabolic rate and food consumption of two sympatric hummingbird species in southeastern Arizona. *Condor* 96:141–150. doi.org/10.2307/1369071
- Powers, D. R., and *T. McKee*. 1994. The effect of food availability on time and energy expenditures of territorial and non-territorial hummingbirds. *Condor* 96:1064–1075. doi.org/10.2307/1369115
- Powers, D. R. 1992. Effect of temperature and humidity on evaporative water loss in Anna's Hummingbird (*Calypte anna*). *Journal of Comparative Physiology B* 162:74–84. doi.org/10.1007/BF00257939
- Powers, D. R. 1991. Diurnal variation in mass, metabolic rate, and respiratory quotient in Anna's and Costa's Hummingbirds. *Physiological Zoology* 64:860–880. doi.org/10.1086/physzool.64.3.30158211
- Powers, D. R., and K. A. Nagy. 1988. Field metabolic rate and food consumption by free-living Anna's hummingbirds (*Calypte anna*). *Physiological Zoology* 61:500–506. doi.org/10.1086/physzool.61.6.30156158
- Powers, D. R. 1987. Effects of variation in food quality on the breeding territoriality of the male Anna's hummingbird. *Condor* 89:103–111. doi.org/10.2307/1368763

INVITED ADDRESSES (2000 TO PRESENT)

- | | |
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| 2021 | University of Montana
Endothermy in the air: warming climates and the challenges birds face managing body temperature |
| 2017 | Forschungsanstalt WSL, Birmensdorf, Switzerland
Hovering in the heat: climate change impact on hummingbird foraging. |
| 2017 | Southwestern Research Station
Hovering in the heat: potential impact of climate change on hummingbird foraging. |
| 2016 | National Aeronautics and Space Administration (Climate Work Group)
Using remote sensing and physiological data to predict consequences of climate change on hummingbird behavior. |
| 2009 | Cooper Ornithological Society: Hummingbird Conservation Symposium
“Energy, water, and physiological design.” |
| 2006 | American Physiological Society (William Calder III Symposium)
“Torpor Use in Socially Dominant and Subordinate Hummingbirds” |
| 2004 | Life in the Cold XII (Hibernation Symposium)
“The Impact of Social Interactions on Torpor use in Hummingbirds” |
| 2002 | North American Ornithological Conference
“Torpor use by hummingbirds: the costs and benefits of nocturnal hypothermia.” |

PAPERS GIVEN (2010 TO PRESENT)

Names in **bold** are undergraduate student co-authors. Names in ***bold italics*** are undergraduate student presenters.

- 2026 European Federation of Animal Science
Minimal evidence for locomotor imitation in pullets: Insights from a ramp vs Jump two-action procedure
- 2026 European Federation of Animal Science
Implementation of flight-maneuver training in commercial rearing: No extra energy costs
- 2026 European Federation of Animal Science
Prenatal motor activity in layer embryos: first evidence of sex-linked differences And exploration of strain effects
- 2026 European Federation of Animal Science
Left-side dominance in laying hens: an investigation of chick lateralization following a 10-week exercise regime
- 2025 Society of Integrative and Comparative Biology
Tail flaring serves as a key signal in male-male hummingbird fighting
- 2024 Society of Integrative and Comparative Biology
Different ways for the same result: heat dissipation areas role in maintain bird body temperature
- 2023 Society of Integrative and Comparative Biology (**Emily Blackwell**)
Surface body temperature as a proxy for metabolic rate during torpor in hummingbirds
- 2023 Society of Integrative and Comparative Biology (**Whitney Dobbyn**)
Body plumage as a barrier to heat dissipation in southwestern Arizona hummingbirds
- 2023 Society of Integrative and Comparative Biology (**Emily Blackwell**)
Differential gene expression analysis across organs during daily torpor in Anna's hummingbirds
- 2023 Society of Integrative and Comparative Biology (**Emma Ortiz, Kendra Wisenbaker**)
Microclimate characteristics of perches used post-flight by SE Arizona hummingbirds
- 2023 Society of Integrative and Comparative Biology (**Emily Blackwell**)
Hold and cold hummingbirds: what genes does a cold hummingbird functioning at 10% express?
- 2023 Society of Integrative and Comparative Biology (**Kendra Wisenbaker, Emma Ortiz**)
Do hummingbirds select microclimates to assist in post-flight heat dissipation in a high temperature?
- 2023 Society of Integrative and Comparative Biology (**Emily Blackwell**)
Differential gene expression between normothermy and torpor in 4 brain regions in *Calypte anna*

- 2022 Society of Integrative and Comparative Biology
Effects of local adrenergic blocking of smooth muscle activity upon thermoregulation in pigeons post flight
- 2022 Society of Integrative and Comparative Biology (**Whitney Dobbyn, Tiffany Regier**)
Effectiveness of passive heat dissipation in free-living Anna's hummingbirds (*Calypte anna*) at moderate and high ambient temperature
- 2022 Society of Integrative and Comparative Biology (**Whitney Dobbyn, Tiffany Regier**)
Radiative heat management by free-living hovering hummingbirds
- 2022 Society of Integrative and Comparative Biology (**Emily Blackwell**)
Temperature, metabolism, and gene expression across metabolic states from normothermy to torpor in hummingbirds
- 2022 Society of Integrative and Comparative Biology (**Emily Blackwell**)
Is surface body temperature a good indicator of metabolic state in hummingbirds during torpor?
- 2022 Society of Integrative and Comparative Biology (**Audrey Smith**)
Use of the bill as a heat radiator by Anna's hummingbirds, *Calypte anna*
- 2022 Society of Integrative and Comparative Biology (**Audrey Smith**)
Importance of heat dissipation while perching following hovering bouts in hummingbirds
- 2022 Society of Integrative and Comparative Biology
Span efficiency and wake dynamics during hovering and forward flight in hummingbirds
- 2021 Society of Integrative and Comparative Biology
Physiological and behavioral flexibility in heat budget-management during hovering in hummingbirds
- 2021 Society of Integrative and Comparative Biology (**Isabelle Cisneros, Sarah Thompson**)
A spectrum of sleep, shallow torpor, and deep torpor in hummingbirds
- 2021 Society of Integrative and Comparative Biology
Energy budgets to explain allometry: lessons from flying ninja hummingbirds
- 2020 Society of integrative and Comparative Biology (**Elliot Shannon**)
Body-temperature management by hovering and perching hummingbirds in cold and warm temperatures.
- 2020 Society of integrative and Comparative Biology (**Elliot Shannon**)
Heat Dissipation by Hummingbirds during Perching Following a Hovering Bout
- 2020 Society of Integrative and Comparative Biology (**Nathaniel Shiiki**)
Do Hummingbirds Select Perch Microclimates to Maximize Their Ability to Dissipate Heat?
- 2020 North American Ornithological Conference (**Isabelle Cisneros, Sarah Thompson**)
Bird sleep and torpor: a continuous physiological and genetic continuum?

- 2019 Society of Integrative and Comparative Biology (**Isabelle Cisneros**)
Deep vs shallow torpor: nocturnal body temperature management in hummingbirds
- 2019 Society of Integrative and Comparative Biology (**Sarah Thompson**)
Is daytime mass management and pre-roost hyperphagia common in hummingbirds?
- 2019 Society of Integrative and Comparative Biology (**Natalie Amodel**)
Use of post-hovering behavior to dissipate accumulated heat in hummingbirds
- 2020 Society of Integrative and Comparative Biology
Body-Temperature Management by Hovering and Perching Hummingbirds in Cold and Warm Temperatures
- 2018 Society of Integrative and Comparative Biology (**Kaheela Reid**)
Are hummingbird bills used in thermoregulation during hovering?
- 2018 Society of Integrative and Comparative Biology (**Isabelle Cisneros**)
Patterns of Nighttime Body-Temperature Regulation in Hummingbirds
- 2018 Society of Integrative and Comparative Biology
Budgeting Body Heat by Hummingbirds during Hovering at Moderately High Temperature
- 2018 Society of Integrative and Comparative Biology (**Isabelle Cisneros**)
From Shallow to Deep: A Torpor Spectrum in Hummingbirds
- 2018 Society of Integrative and Comparative Biology
Do physiological adjustments to high foraging effort affect reproduction?
- 2017 Society of Integrative and Comparative Biology (**Joey Canepa**)
Energy budgeting in a temperate hummingbird
- 2017 Society of Integrative and Comparative Biology (**Elizah Stephens**)
Does Poor Feeder Maintenance Increase Exposure of Hummingbirds to Pathogenic Bacteria and Fungi?
- 2017 Society of Integrative and Comparative Biology (**Julie Litchfield**)
Do Near-Field Changes in Surface Temperature Provide Evidence for Physiological Control of Heat Dissipation in Hummingbird During Flight?
- 2017 Society of Integrative and Comparative Biology
The Scaling of Mechanochemical Efficiency of Hovering Hummingbirds.
- 2017 Society of Integrative and Comparative Biology (**Katie Langland**)
Impact of Climate Change on thermoregulation during Hovering in Hummingbirds.
- 2017 Society of Integrative and Comparative Biology (**Nathan Weston**)
Using Deuterium-Enriched Sucrose Solution to Measure the Energetic Importance of Artificial Feeders

- 2017 Society of Integrative and Comparative Biology
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