

## *Curriculum Vitae* Henry Charles Astley

Biomimicry Research & Innovation Center  
Depts. of Biology & Polymer Science  
University of Akron  
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### Education:

- PhD in Biology, Brown University, 2013  
Topic: Performance, Mechanics, and Diversity of Anuran Jumping
- M.S. in Biology, University of Cincinnati, 2008.  
Topic: Habitat structure affects arboreal locomotion of snakes
- B.S. in Biology, University of Cincinnati, 2005. Minor: Mathematics
- B.S. in Aerospace Engineering, Florida Institute of Technology, 2001

### Positions

- 8/2023 – current Associate Professor, University of Akron, Biomimicry Research & Innovation Center. Primary Dept.: Biology, Secondary Dept.: Polymer Science & Engineering
- 8/2016 – 8/2023 Assistant Professor, University of Akron, Biomimicry Research & Innovation Center. Primary Dept.: Biology, Secondary Dept.: Polymer Science.
- 8/2013 – 7/2016 Physics of Living Systems Post-doctoral fellow, Georgia Institute of Technology, Goldman Lab

### Publications

- Tingle, J. L., Garner, K. L., & Astley, H. C. (2024). Functional diversity of snake locomotor behaviors: A review of the biological literature for bioinspiration. *Ann NY Acad Sci*, 1–22. <https://doi.org/10.1111/nyas.15109>
- Tingle, J. L., Jurestovsky, D. J., & Astley, H. C. (2023). The relative contributions of multiarticular snake muscles to movement in different planes. *Journal of Morphology*, 284, e21591. <https://doi.org/10.1002/jmor.21591>
- Jurestovsky, D. J., Joy, S., and Astley, H.C. (2023). Blood python (*Python brongersmai*) strike kinematics and forces are robust to variations in substrate geometry. *Journal of Experimental Biology* 226 (2). <https://doi.org/10.1242/jeb.244456>
- Jurestovsky, D. J., Tingle, J. L., and Astley, H. C. (2022). Corn Snakes Show Consistent Sarcomere Length Ranges Across Muscle Groups and Ontogeny. *Integrative Organismal Biology*. <https://doi.org/10.1093/iob/obac040>
- Fu, Q., Astley, H.C., Li, C. (2022). Snakes combine vertical and lateral bending to traverse uneven terrain. *Bioinspiration & Biomimetics*. <https://doi.org/10.1088/1748-3190/ac59c5>
- Howe, S., Bryant, K., Duff, A., Astley, H.C. (2021). Testing the effects of body depth on fish maneuverability via robophysical models. *Bioinspiration & Biomimetics*. <https://doi.org/10.1088/1748-3190/ac33c1>

- Jurestovsky, D. J., Usher, L. R., Astley, H. C. (2021). Generation of propulsive force via vertical undulations in snakes. *J Exp Biol* 224 (13): jeb239020. <https://doi.org/10.1242/jeb.239020>
- Howe, S., Duff, A., & Astley, H. (2021). Comparing the turn performance of different motor control schemes in multilink fish-inspired robots. *Bioinspiration & Biomimetics*. <https://doi.org/10.1088/1748-3190/abe7cc>
- Herndon, C., Astley, H. C., Owerkowicz, T., & Fenton, F. H. (2021). Defibrillate you later, alligator; Q10 scaling and refractoriness keeps alligators from fibrillation. *Integrative Organismal Biology*. <https://doi.org/10.1093/iob/obaa047>
- Astley, H., Rieser, J., Kaba, A., Paez, V. M., Tomkinson, I. K., Mendelson, J., and Goldman, D. I. (2020). Side-impact collision: Mechanics of obstacle negotiation in sidewinding snakes. *Bioinspiration & Biomimetics*, v 16, n 6. <https://doi.org/10.1088/1748-3190/ABB415>
- Howe, S. P., and Astley, H. C. (2020). The control of routine fish maneuvers: Connecting midline kinematics to turn outcomes. *Journal of Experimental Zoology Part A: Ecological and Integrative Physiology*, jez.2398. <https://doi.org/10.1002/jez.2398>
- Astley, H.C. The Biomechanics of Multi-articular Muscle–Tendon Systems in Snakes. *Integr Comp Biol*. 2020;60(1):140–155. <https://doi.org/10.1093/icb/icaa012>
- Astley, H.C. Long Limbless Locomotors Over Land: The Mechanics and Biology of Elongate, Limbless Vertebrate Locomotion. *Integr Comp Biol*. 2020;60(1):134–139. <https://doi.org/10.1093/icb/icaa034>
- Schiebel, P. E., Astley, H.C., Rieser, J.M., Agarwal, S., Hubicki, C., Hubbard, A.M., Diaz, K., Mendelson III, J. R., Kamrin, K., and Goldman, D.I. Mitigating memory effects during undulatory locomotion on hysteretic materials. *eLife* 2020;9:e51412 <https://doi.org/10.7554/eLife.51412>
- Jurestovsky, D. J., Jayne, B. C., and Astley, H. C. Experimental modification of morphology reveals the effects of the zygosphen–zygantrum joint on the range of motion of snake vertebrae. *J Exp Biol* 223:jeb216531 <https://doi.org/10.1242/jeb.216531>
- Astley H.C., Mendelson J.R., Dai J., Gong C., Chong B., Rieser J.M., Schiebel P.E., Sharpe S.S., Hatton R.L., Choset H., Goldman D.I. (2020) Surprising simplicities and syntheses in limbless self-propulsion in sand. *J Exp Biol* 223:jeb103564. <https://doi.org/10.1242/jeb.103564>
- Langowski, J.K.A., Singla, S., Nyarko, A., Schipper, H. van den Berg, F. T., Kaur, S., Astley, H. C., Gussekloo, S. W. S., Dhinojwala, A., and van Leeuwen, J. L. (2019) Comparative and functional analysis of the digital mucus glands and secretions of tree frogs. *Frontiers in Zoology*, 16:19. <https://doi.org/10.1186/s12983-019-0315-z>
- Han, S. I., Astley, H. C., Maksuta, D. D., and Blackledge, T. A. (2019) External power amplification drives prey capture in a spider web. *Proceedings of the National Academy of Sciences*, 116(24), 12060–12065. <https://doi.org/10.1073/pnas.1821419116>
- Reynaga, C. M., Astley, H. C., and Azizi, E. (2018) Morphological and kinematic specializations of walking frogs. *Journal of Experimental Zoology A*, 329:87–98; [doi: 10.1002/jez.2182](https://doi.org/10.1002/jez.2182)
- Astley, H.C., Astley, V.E., Brothers, D., and Mendelson, J.R. (2017) Digital Analysis of Photographs for Snake Length Measurement. *Herpetological Review*, 48(1), 39–43.
- Astley, H.C. (2016) The diversity and evolution of locomotor muscle properties in anurans. *Journal of Experimental Biology*, 219, 3163–3173; [doi: 10.1242/jeb.142315](https://doi.org/10.1242/jeb.142315)

- Camp, A. L., Astley, H.C., Horner, A.M., Roberts, T.J., and Brainerd, E.L. (2016) Fluoromicrometry: A Method for Measuring Muscle Length Dynamics with Biplanar Videofluoroscopy. *Journal of Experimental Zoology A*, Vol. 325 no 7 pp 399–408; [doi: 10.1002/jez.2031](https://doi.org/10.1002/jez.2031)
- McInroe, B.\*, Astley, H.C.\*, Gong, C., Kawano, S., Schiebel, P.E., Rieser, J.M., Choset, H., Blob, R.W., and Goldman, D.I. (2016) Tail use improves performance on soft substrates in models of early vertebrate land locomotors. *Science*, Vol. 353 no 6295 pp 154-158; [doi: 10.1126/science.aaf0984](https://doi.org/10.1126/science.aaf0984) \*Co-First-Authors
- Gong, C., Travers, M., Astley, H. C., Li, L., Mendelson, J., Goldman D. I., and Choset, H. (2016) Kinematic gait synthesis for snake robots. *The International Journal of Robotics Research*, Vol. 35 Issue 1-3, pp 100-113; [doi:10.1177/0278364915593793](https://doi.org/10.1177/0278364915593793)
- Astley, H.C., A. Haruta, and Roberts, T.J. (2015) Robust Jumping Performance and Elastic Energy Recovery from Compliant Perches in Tree Frogs. *Journal of Experimental Biology*, 218, 3360-3363; [doi:10.1242/jeb.121715](https://doi.org/10.1242/jeb.121715)
- Astley, H. C., Gong, C., Dai, J., Travers, M., Serrano, M. M., Vela, P. A., Choset, H., Mendelson, J. R., Hu, D., and Goldman, D. I. (2015) Modulation of orthogonal body waves enables high maneuverability in sidewinding locomotion. *Proceedings of the National Academy of Sciences*, vol. 112 no. 19, pp. 6200–6205 [doi: 10.1073/pnas.1418965112](https://doi.org/10.1073/pnas.1418965112)
- Astley, H. C., and Roberts, T. J. (2014) The mechanics of elastic loading and recoil in anuran jumping. *Journal of Experimental Biology*, 217, 4372-4378 [doi:10.1242/jeb.110296](https://doi.org/10.1242/jeb.110296)
- Marvi, H., Gong, C., Gravish, N., Astley, H. C., Travers, M., Hatton, R. L., Mendelson III, J. R., Choset, H., Hu, D. L., and Goldman, D. I. (2014) Sidewinding with minimal slip: snake and robot ascent of sandy slopes. *Science*, Vol. 346 no. 6206 pp. 224-229; [doi: 10.1126/science.1255718](https://doi.org/10.1126/science.1255718)
- Astley, H. C., Abbot, E. M., Azizi, E., Marsh, R. L., and Roberts, T. J. (2013) Chasing maximal performance: A cautionary tale from the celebrated jumping frogs of Calaveras County. *Journal of Experimental Biology*, 216, 3947-3953. [doi:10.1242/jeb.090357](https://doi.org/10.1242/jeb.090357)
- Astley, H. C. (2012) Getting around when you're round: quantitative analysis of the locomotion of the blunt-spined brittle star *Ophiocoma echinata*. *Journal of Experimental Biology*, 215, 1923-1929. [doi: 10.1242/jeb.068460](https://doi.org/10.1242/jeb.068460)
- Astley, H. C. and Roberts, T.J. (2012) Evidence for a vertebrate catapult: elastic energy storage in the plantaris tendon during frog jumping. *Biology Letters*, vol. 8 no. 3 386-389 [doi: 10.1098/rsbl.2011.0982](https://doi.org/10.1098/rsbl.2011.0982)
- Astley, H. C. and Jayne, B.C. (2009) Arboreal habitat structure affects the performance and modes of locomotion of corn snakes (*Elaphe guttata*). *Journal of Experimental Zoology*, 311A: 207-216. [doi: 10.1002/jez.521](https://doi.org/10.1002/jez.521)
- Astley, H. C. and Jayne, B.C. (2007) Effects of perch diameter and incline on the kinematics, performance and modes of arboreal locomotion of corn snakes (*Elaphe guttata*). *Journal of Experimental Biology*, 210: 3862-3872. [doi: 10.1242/jeb.009050](https://doi.org/10.1242/jeb.009050)

### Peer-Reviewed Engineering Conference Proceedings

- Astley, H.C. (2018) Traversing Tight Tunnels—Implementing an Adaptive Concertina Gait in a Biomimetic Snake Robot. Earth and Space 2018, 16th Biennial International Conference on Engineering, Science, Construction, and Operations in Challenging Environments. [doi.org/10.1061/9780784481899.017](https://doi.org/10.1061/9780784481899.017)

- Dai, J., Travers, M., Dear, T., Gong, C., Astley, H.C., Goldman, D.I., Choset, H. (2015) Robot-Inspired Biology: The Compound-Wave Control Template. *IEEE International Conference on Robotics and Automation (ICRA)*. doi: [10.1109/ICRA.2015.7140022](https://doi.org/10.1109/ICRA.2015.7140022)
- Gong, C., Travers, M., Astley, H. C., Goldman D. I., and Choset, H. (2015) Limbless Locomotors that Turn in Place. *IEEE International Conference on Robotics and Automation (ICRA)*. doi: [10.1109/ICRA.2015.7139720](https://doi.org/10.1109/ICRA.2015.7139720)
- Gong, C., Travers, M., Astley, H. C., Li, L., Mendelson, J., Hu, D. L., Goldman D. I., and Choset, H. (2014) Conditioned Basis Array Factorization: An Approach to Gait Pattern Extraction. *Robotics: Science and Systems*. Published [online](#), in press (Edited by Dieter Fox, Lydia E. Kavraki and Hanna Kurniawati, ISBN 978-0-9923747-0-9).

### Book Chapters

“Slithering across worlds—snake-inspired robots for extraterrestrial exploration”, in *Biomimicry for Aerospace: Technologies and Applications*, 2022. Eds. Vikram Shyam, Marjan Eggermont, Aloysius Hepp.

### Invited Talks & Workshops

- International Workshop on Biodiversity and Bioinspiration, Universiti Brunei Darussalam, 1/2023
- “To Move a Snake: Insights into the Musculoskeletal Function of Snakes and Consequences for Locomotion” for the 11th International Symposium on Adaptive Motion of Animals and Machines, Kobe University, June 2023.
- “Mechanics of Multi-articular Muscles”, for “The Mathematical Laws of Morphology and Biomechanics” Virtual Seminar series, organized by Kathleen Foster and Alessandro Selvitella, November 2022
- Integrative Organismal Modeling of Movement workshop series, Physical Models for Evolutionary Biology section, August 2022
  - “Physical Models for Evolutionary Biology”, co-Presenter
  - “Actuating Physical Models”, co-Presenter
- “Robotic Reptiles & Slithering Servomotors: Biomimetic Snake Robots for Exploration, Rescue, and Repair”, Penn State University, Sigma Xi, February 2021
- “Control & Evolution of Sidewinding”, Johns Hopkins University Seminar, Dept. of Mechanical Engineering, February 2020
- “Snake Patterns & Predation”, Visual Research class at Amsterdam Applied University, February 2019
- “Control and evolution of sidewinding”, Ohio University Seminar, November 2018
- “Robotic Reptiles & Slithering Servomotors: Biomimetic Snake Robots for Exploration, Rescue, and Repair”, Cleveland Museum of Natural History, November 2018
- “Control and evolution of sidewinding”, John Carroll University Seminar, March 2018
- “Control and evolution of sidewinding”, Case Western Reserve University Seminar, February 2018
- “Control and evolution of sidewinding”, guest lecture in Introduction to Biomimicry, RISD winter intersession course, January 2018
- “Control and evolution of sidewinding”, Brown University Morphology Group Seminar, January 2018.

- “Snakes in Space: Limbless Biomimetic Snake Robots for Extraterrestrial Exploration”, Nature-Inspired Exploration for Aerospace Summit 2017, October 2017
- “First Steps: Using Biological and Robotic Models to Understand the Vertebrate Colonization of Land”, Robotics-Inspired Biology Symposium at Intelligent Robots & Systems (IROS) Conference, Vancouver, September 2017
- “Control and evolution of sidewinding”, NEOMED Seminar Series, May 2017
- “Control and evolution of sidewinding”, University of Akron Biology Colloquium, September 2016.
- “Crucial advantages of tail use in the evolution of vertebrate terrestrial locomotion”, Atlanta Metro Physics Teachers group, November 2015.
- “The Diversity and Evolution of Locomotor Muscle Properties in Anurans”, Determinants of Skeletal Muscle Diversity Symposium (E. Azizi & L. P. Hernandez), American Physiological Society Intersociety Meeting: Comparative Approaches to Grand Challenges in Physiology. October 2014
- “Performance, Mechanics and Diversity of Anuran Jumping”, Rowland Institute, February 2013

#### **External Grants Funded**

- “CAREER: The Musculoskeletal Biomechanics and Control of Limbless Locomotion”, NSF BIO IOS Award #2045581, 5/1/21-4/30/26, \$1,111,830.00
- “First Steps: The Dynamics and Control of Underwater Walking”, NSF Award #1929900, 9/1/19-8/31/21, \$297,267
- Workshop: Designing a Network for Undergraduate Biomimicry Research and Education, NSF RCN UBE Award #1747598, 8/1/17-7/31/18, \$19,840

#### **External Grants (Advisory Capacity Only)**

- “Advancing access equity and user safety through bio-inspired all-terrain mobility solutions”, NSF I-Corps Teams Award #2330074, 6/1/23-11/31/23, \$50,000

#### **Internal Grants Funded**

- Principles governing the mechanics and control of snake strikes. Collaborative Research Initiative with Zoo Atlanta, funded by The Elizabeth Smithgall Watts Endowment and the Georgia Tech School of Biology. Funded 2015. \$11,500
- Natural substrate and behavior of wild sidewinders. Collaborative Research Initiative with Zoo Atlanta, funded by The Elizabeth Smithgall Watts Endowment and the Georgia Tech School of Biology. Funded 2014. \$7,500
- Turning without legs: the mechanics and control of maneuverability in snakes. Collaborative Research Initiative with Zoo Atlanta, funded by The Elizabeth Smithgall Watts Endowment and the Georgia Tech School of Biology. Funded 2013. \$10,000
- Jumping with your ancestor’s legs: The influence of phylogeny and function on musculoskeletal properties in anurans. Sigma Xi Grant In Aid of Research. Funded 2012. \$800.
- Moving on limbs without limbs: Muscular mechanisms of the arboreal locomotion of snakes. Wieman/Wendel/Benedict Award. Funded 2007. \$1,200

- Moving on limbs without limbs: How perch diameter and incline affect the arboreal locomotion of snakes. University of Cincinnati graduate student summer research fellowship. Funded July & August 2006. \$3,000

### **Awards**

- Early Career Research & Creativity Award, Buchtel College of Arts & Sciences, U. of Akron, 2023
- Akron Community Engaged Scholar – Center for Experiential Learning, U. of Akron, 2023
- 2013 John G. Peterson Pre-doctoral Fellow, Brown University
- Best Student Presentation, Honorable Mention, SICB 2012
- Outstanding Teaching Assistant – Lower Division Courses, U. of Cincinnati, 2008

### **Peer Reviews for:**

Journal of Experimental Biology  
 Bioinspiration & Biomimetics  
 Proceedings of the Royal Society B  
 Journal of Experimental Zoology A  
 Journal of Comparative Physiology B  
 Functional Ecology  
 The Herpetological Journal  
 Herpetologica  
 Journal of Zoology  
 PLoS ONE  
 Zoology  
 Herpetological Conservation and Biology  
 PeerJ  
 BMC Evolutionary Biology  
 Journal of Evolutionary Biology  
 Journal of Morphology  
 Evolution  
 Integrative & Comparative Biology  
 Robotics and Autonomous Systems  
 NSF BIO  
 Nature Communications

### **Teaching Experience**

- Courses:
  - The Biology of Monsters (undergrad) seminar/outreach course, U. of Akron
  - Digital Skills for Biologists (grad-level skills course), mixed lab/lecture fusion, U. of Akron
  - Comparative Biomechanics (grad/undergrad-level), lecture, U. of Akron
  - Anatomy & Physiology (undergrad), lecture, U. of Akron
- Guest Lectures:
  - “Bioinspired Robotics and Snakebots”, Bioinspired Robotics, (Dr. Nourhani), 2/23

- “Biomimetic Robotic Control”, Robotics, (Dr. Mahajan), 4/22
- “Biomimetic Robotic Control”, Biomimicry & Entrepreneurship (Dr. Nadkarni), 1/22
- “Evolution and Diversity of Connective Tissue” and “Function & Mechanics of Connective Tissue”, Connective Tissues (Dr. Sahai), 1/22
- “Biomimetic Robotic Control”, Biomimicry Foundations (Dr. Niewiarowski), 11/21
- “Biomimetic Robotic Control”, Robotics, (Dr. Mahajan), 4/21
- “Biomimetic Robotic Control”, Biomimicry & Entrepreneurship (Dr. Nadkarni), 1/21
- “Biomimetic Robotic Control”, Introduction to Biomimicry (Dr. Niewiarowski), 11/20
- Demonstration for Dr. Kolodziej’s art class
- “Biomimetic Robotic Control”, Introduction to Biomimicry (Dr. Niewiarowski), 11/5/19
- “Biomimetic Robotic Control”, Biomimicry & Entrepreneurship class, (Dr. Nadkarni), 2/20
- Demonstration on snakes for Dr. Niewiarowski’s Vertebrate Zoology lab 10/7/19
- “Power Amplified Jumping in Anurans”, 4/24/20, Master Herpetologist Class
- “Biomimetic Robotic Control”, Biomimicry & Entrepreneurship class, (Dr. Nadkarni), 2/19
- “Biomimetic Robotic Control”, Robotics, (Dr. Mahajan), 4/19
- “Snake Patterns & Predation” Visual Research class at Amsterdam Applied University, (Dr. van den Driesche) 2/19
- “Biomimetic Robotic Control”, Biomimicry & Entrepreneurship (Dr. Nadkarni), 2/18
- “Control and evolution of sidewinding”, guest lecture in Introduction to Biomimicry (Dr. Kennedy), RISD winter intersession course, 1/18
- “Snake scales”, Biomimicry Design Challenge class (Dr. Gruber), 9/17
- “Mechanics of Animal Locomotion”, 2/17, Biomimicry Design Challenge (Dr. Petra Gruber), U. of Akron
- “Vertebrate Paleontology Through the Lens of Functional Morphology”, 10/15, Georgia State University’s Vertebrate Paleontology class.
- “Mechanics of Animal Locomotion”, 1/15, Georgia Tech’s Vertebrate Zoology class.
- Graduate Teaching Assistant:
  - August 2009 – January 2013. Brown University, Alpert Medical School.
    - Mean evaluation score: 4.8/5.0
    - Staffed all lab sections of a double-credit cadaver-based dissection lab, participated in lectures, exam prep, grading, and course development.
    - Guest lectures on the body wall (10/2013) and compartments of the leg (10/2012).
  - September 2005 – June 2008. University of Cincinnati, Dept. of Biological Sciences.
    - Outstanding Teaching Assistant Award, Lower-division courses

- Staffed laboratory sections for freshman anatomy and physiology lab sections, including short lectures, exam preparation, grading, and laboratory management
- Staffed laboratory section for an upper-level Vertebrate Zoology course, including specimen curation, exam preparation, grading, and live specimen demonstrations.
- Staffed laboratory section for an upper-level, project-based Human Physiology & Biomechanics course, including equipment maintenance and troubleshooting, after-hours access for projects, student guidance and exam evaluation.
- September 2001 – June 2002. University of Cincinnati, Department of Aerospace Engineering.
  - Recitation sections for sophomore-level statics and dynamics classes, including class-wide problem demonstrations and exam grading.

### **Professional Affiliations**

- Society for Integrative and Comparative Biology
- Society for Experimental Biology
- American Society of Biomechanics
- American Society of Ichthyologists and Herpetologists
- Sigma XI

### **Field Experience**

- With B.C. Jayne, project: Arboreal locomotion of the Brown Tree Snake (*Boiga irregularis*), Guam, August 21<sup>st</sup> to September 12<sup>th</sup>, 2005.
- With M. Bertness, project: Locomotor modes of brittle stars, Belize, January 12<sup>th</sup> to 19<sup>th</sup>, 2009
- With T. Roberts & R. Marsh, project: Maximal performance and the Celebrated Jumping Frogs of Calaveras County, Angel's Camp, CA, May 12<sup>th</sup> to 18<sup>th</sup>, 2009
- With P. Schiebel, project: Preliminary field observations of sidewinder and fringe-toed lizard locomotor behavior and habitat. Sonora Desert, Yuma, AZ, September 20<sup>th</sup> to 23<sup>rd</sup>, 2013

### **Service:**

Symposium Organizer, “Long Limbless Locomotors Over Land: The mechanics and biology of elongate, limbless vertebrate locomotion”, 2020 Meeting of the Society for Integrative & Comparative Biology

Session Chair, “Muscle Physiology I”, 2019 Meeting of the Society for Integrative & Comparative Biology

Judge, Best Student Poster Competition, Society for Integrative & Comparative Biology, Division of Vertebrate Morphology, January 2018

Organizer for Midwest Regional Society for Integrative & Comparative Biology, October 2017, Akron, OH.

Co-organizer for the “Robotics-Inspired Biology” Symposium at Intelligent Robots & Systems (IROS) conference in Vancouver, Canada, 9/28/17



Organizer for Southeastern Regional Society for Integrative & Comparative Biology,  
October 2015, Atlanta, GA  
Session Chair, "Towards a General Framework for Predicting Animal Movement Speeds  
in Nature", 2015 Meeting of the Society for Integrative & Comparative Biology  
Session Chair, "Complementary session: Terrestrial locomotion: Where do we stand,  
where are we going?", 2014 Meeting of the Society for Integrative &  
Comparative Biology  
President, Graduate Student Association, Dept. of Ecology & Evolutionary Biology,  
2012  
Session chair, "Terrestrial Biomechanics: Jumping", 2012 Meeting of the Society for  
Integrative & Comparative Biology  
Brown Bag Seminar Series co-organizer, Brown University, Department of Ecology and  
Evolutionary Biology Spring 2011  
Session chair, "Gait, Rattle & Roll", 2011 Meeting of the Society for Integrative &  
Comparative Biology

### **Graduate Students**

Stephen Howe (Ph.D.)  
Derek Jurestovsky (Ph.D.)  
Colleen Unsworth (Ph.D.)  
Kaelyn Gamel (Ph.D.)  
Hope Zimmerman (Ph.D. Student)  
Charles Edwards (Ph.D. Student)  
Kelsey Garner (Ph.D. Student)

### **Undergraduate Students Supervised:**

#### **U. of Cincinnati:**

Alex Sturbaum (High School student, currently at Oberlin)

#### **Brown:**

Alison Haruta (Undergraduate, Biology)  
Caleb Anderson (High School student)

#### **Georgia Tech:**

Benjamin McInroe (Undergraduate, Physics)  
Luke Buffardi (Undergraduate, Physics)  
Navya Palacherla (Undergraduate, Mechanical Engineering)  
Mark Lowder (Undergraduate, Biology)  
Mohammed Aamir (Undergraduate, Mechanical Engineering)

#### **U. of Akron:**

Emily Trenka (Undergraduate, Computer Science)  
Sophie Cressman (Undergraduate, Biochemistry & Applied Math)  
Dana Cressman (Undergraduate, Chemical Engineering)  
Amith Rao (Undergraduate, Natural Sciences)  
Hamna Siddiqui (REU student (Dennison University), Biochemistry)  
Dalia Laredo (REU student (Carnegie Mellon Uni.), Chemical Engineering)  
David Leffler (Undergraduate, Biology)  
Nicholas Stricklen (Undergraduate, Exercise Science)

Christina Lee (Undergraduate, Biology/Psychology)  
 Jennifer McCoy (RET Teacher)  
 Megan Lee (Undergraduate, Biology)  
 Walid Abuhashim (Undergraduate, Biomedical Engineering)  
 Logan Usher (Undergraduate, Biology)  
 Nour Shakaki (Undergraduate, Psychology)  
 Stephen Adasolna (REU Student, (Cheyney University of Pennsylvania), Biology)  
 Kelly Bryant (Undergraduate, Biology)  
 Andrew Duff (Undergraduate, Mechanical Engineering)  
 Nathalay Cisneros (Undergraduate, Biomedical Science)  
 Tabitha Cooper (Undergraduate, Biology)  
 Colton Kemp (Undergraduate, Mechanical & Biomedical Engineering)  
 Andrew Preston Kovac (Undergraduate, Mechanical Engineering)  
 Dev Patel (Undergraduate, Biology)  
 Zachary Nopper (Undergraduate, Mechanical Engineering)  
 Wenli Wu (Undergraduate, Biology)  
 Sid Joy (High School Student)  
 Emily Newenhisen (Undergraduate, Biology)  
 Jacob Newell (Undergraduate, Mechanical Engineering)  
 Jarey Pettay (Undergraduate, Biomedical Science)  
 Ava Umlauf (Undergraduate, Biology)  
 Zachary Nopper (Undergraduate, Mechanical Engineering)  
 Daniel Bartlett (Undergraduate, Biology)

### **Abstracts, Presentations & Posters**

- Bartlett, D. T., Raffle, K., Pettit, H., Brainard, M., Houghlan, P., Gamel, K.M., Nopper, Z. O., Harden, R., Astley, H.C., Garner, A. M., Londraville, R. L. Fish Out of Water: Effect of Substrate on Jumping Forces in the Blackspotted Rockskipper. (1/2024). Annual meeting of the Society for Integrative and Comparative Biology. (Seattle, WA)
- Garner, K. L., Tingle, J. L., Astley, H. C. Do repetitive locomotor trials lead to reduced muscle strain in snakes? (1/2024). Annual meeting of the Society for Integrative and Comparative Biology. (Seattle, WA)
- Nopper, Z., Gamel, K. M., Bartlett, D. T., Astley, H.C. Calculating Joint Torques in Axolotls during Underwater Walking with Aquatic Force Plate. (1/2024). Annual meeting of the Society for Integrative and Comparative Biology. (Seattle, WA)
- Tingle, J. L., Garner, K. L., Astley, H.C. An in vivo examination of snake muscle shortening and vertebral column curvature using X-ray video. (1/2024). Annual meeting of the Society for Integrative and Comparative Biology. (Seattle, WA)
- Gamel, K. M., Astley, H. C., Flammang, B.E. Fish out of Water: Kinetics of Amphibious Transition. (1/2024). Annual meeting of the Society for Integrative and Comparative Biology. (Seattle, WA)
- Edwards, C. S., Astley, H.C. Head rotation impacts the force required for penetration in damp granular media. (1/2024). Annual meeting of the Society for Integrative and Comparative Biology. (Seattle, WA)

- Tingle, J. L., Jurestovsky, D. J., Astley, H. C. The relative contributions of multiarticular snake muscles to movement in different planes. (8/2023). 46th American Society for Biomechanics Annual Meeting. (Knoxville, TN).
- Tingle, J. L., Jurestovsky, D. J., Astley, H. C. The relative contributions of multiarticular snake muscles to movement in different planes. (7/2023). Joint Meeting of Ichthyologists and Herpetologists (JMIH). (Norfolk, VA).
- Gamel, K. M., Astley, H. C. Using Inverse Dynamics to Quantify Joint Mechanics of Underwater Walking in Axolotls. (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Nopper, Z., Gamel, K. M., Astley, H.C. Detecting Hydrodynamic Wake Forces with an Underwater Force Plate. (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Zhou, H., Donatelli, Gamel, K. M., Astley, H.C., Laneuville, O., Standen, E. Feel it in Your Bones: Differences in the Skeletal Anatomy of Terrestrial and Aquatic Mudskippers. (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Umlauf, A., Astley, H.C., Gamel, K. M., Pettay, J. Underwater Ground Reaction Forces of Spotted Prawn. (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Tingle, J. L., Jurestovsky, D. J., Astley, H. C. The relative contributions of multiarticular snake muscles to movement in different planes. (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Edwards, C. S., Newell, J., Astley, H. C. Lateral head rotation decreases penetration force of a robophysical model in damp granular media. (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Kovac, A. P. Astley, H.C., Unsworth, C.K., Tarchick, M., McNerney. S. The Effects of Crocodilian Tail Serrations on Water Surface Disturbance (1/2023). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Astley, H.C. Frogs as Two-Stage Rockets. (7/2022). Fast Movements, Impacts, and Deformations. (Raleigh, NC)
- Davis, R.A., Cole, M., Astley, H.C., Andronowski, J.M. The Effects of Prolonged Opioid Exposure on Bone Fracture Strength of Rabbit Middle Ribs. (2/2022). American Academy of Forensic Sciences. (Seattle, WA)
- Zimmerman, H., Astley, H.C. Using Mechanical Models to Test the Consequences of Jaw Hinge Offset. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Gamel, K.M., Pinti, S.G., Astley, H.C. Lights, Camera, Axolotl: Exploring the Dynamics of Underwater Walking Using an Underwater Force Plate and Synchronous Videography. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Jurestovsky, D.J., Joy, S.P., Astley, H.C. Cornered snakes strike with more force. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Gamel, K.M., Pinti, S.G., Astley, H.C. Design and Fabrication of a Low-cost, 3D printed Underwater Force Plate. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)

- Edwards, C.S., Astley, H.C. Lateral head movement reduces force required for penetration in damp granular media. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Jurestovsky, D.J., Astley, H.C. Corn snake sarcomeres are predominantly on the descending limb of the length-tension curve. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Zimmerman, H., Small, B.M., Walro, D.F., Astley, H.C. Mesh-like Surface Features of *Castilleja* Seeds Increase Aerodynamic Drag. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Davis, R.A., Gamel, K.M., Andronowski, J.M., Astley, H.C. Micro-scale Fluid Flow in Human Cortical Bone Examined through Reynolds-Matched Flow Testing of 3D Printed Synchrotron  $\mu$ CT Scans. (1/2022). Annual meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ)
- Fu, Q., Astley, H.C., Li, C. Snakes traversing complex 3-D terrain. (2/2021). Annual meeting of the Society for Integrative and Comparative Biology. (online)
- Howe, S.P., Bryant, K., Duff, A., Astley, H.C. Robophysical models clarify the effects of body depth on fish maneuverability. (2/2021). Annual meeting of the Society for Integrative and Comparative Biology. (online)
- Kaba, A.K., Rieser, J.M., Paez, V.M., Astley, H.C., Goldman, D.I. Amplitude Modulation in Sidewinding Locomotion Driven by Contact Sensing Facilitates Movement in Heterogeneous Environments. (3/2020). Annual March Meeting of the American Physics Society. (moved online due to COVID).
- Astley, H. C. Symposium Introduction - Long Limbless Locomotors Over Land: The mechanics and biology of elongate, limbless vertebrate locomotion. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Astley, H.C. Mechanics of Multi-articular Muscles Minimize Moments. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Gamel, K.M, Astley , H.C. Design and Fabrication of an Underwater Force plate. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Howe, S.P., Astley, H.C. Bio-inspired Control Algorithms Integrating Steady Swimming and Maneuvering in Fish Robots. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Jurestovsky, D.J., Usher, L., Astley, H.C. Propulsion via vertical undulation in snakes. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Unsworth, C.K., Astley, H.C. Quantifying the compliance of the millipede body while traversing irregular terrain. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Kaba, A.K., Rieser, J.M., Paez, V.M., Astley, H.C., Goldman, D.I. Amplitude Modulation in Sidewinding Locomotion Driven by Contact Sensing Facilitates Movement in Heterogeneous Environments. (1/2020). Annual meeting of the Society for Integrative and Comparative Biology. (Austin, TX)
- Herndon, C., Astley, H.C., Owerkowicz, T., Fenton, F. Long refractory period protects alligators from cardiac fibrillation across temperature changes. (8/2019) 10th International Congress of Comparative Physiology and Biochemistry. (Ottawa,Canada)

- Howe, S.P., Astley, H.C. Giving Fish Robots a Pulse: Implementing Bio-inspired Control Algorithms in Fish Robots. (3/2019) American Physics Society March Meeting. (Boston, MA)
- Schiebel, P., Rieser, J., Astley, H.C., Hubbard, A. M., Diaz-Cruz, K., Goldman, D.I. Mechanics of snake slithering on deformable substrates. (3/2019) American Physics Society March Meeting. (Boston, MA)
- Paez, V.M., Astley, H.C., Mendelson III, J.M.R., Goldman, D.I. A robophysical model for studying obstacle navigation in sidewinders. (3/2019) American Physics Society March Meeting. (Boston, MA)
- Reiser, J.M., Astley, H.C., Mendelson III, J.M.R., Gong, C. Dai, J., Chong, B., Schiebel, P.E., Ozkan aydin, Y., Hubbard, A.M., Rankin, J.W., Hutchinson, J.R., Hatton, R. L., Choset, H., Goldman, D.I. Geometric mechanics and locomotion in dissipative environments. (3/2019) American Physics Society March Meeting. (Boston, MA)
- Unsworth, C.K., Abuhashim, W.A., Brannoch, S.K., Svenson, G.J., Astley, H.C. Biomechanics of the Praying Mantis Foreleg Strike. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Jurestovsky, D.J., Astley, H.C. The Effect of the Zygosphen/Zygantrum Joint on the Range of Motion in Snake Vertebrae. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Schiebel, P.E., Rieser, J.M., Astley, H.C., Hubbard, A.M., Diaz, K., Goldman, D.I. Mechanics of Snake Slithering on Deformable Substrates. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Astley, H.C., Siddiqui, H.K., Laredo, D. High Hysteretic Energy Loss in Mouse Tendons. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Unsworth, C.K., Tarchick, M.J., McInerney, S.J., Astley, H.C. The Effects of Crocodilian Tail Serrations on Surface Water Disturbance. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Howe, S.P., Leffler, D., Astley, H.C. Midlines in motion: Connecting Midline Curvature Dynamics to Heading Change and Center of Mass Deflection in Fishes. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Rieser, J.M., Astley, H.C., Gong, C., Chong, B., Schiebel, P.E., Rankin, J.W., Michel, K., Nicieza, A., Hutchinson, J.R., Hatton, R.L., Choset, H., Goldman, D.I. Comparative geometric mechanics of animal locomotion in dissipative environments. (1/2019) Annual meeting of the Society for Integrative and Comparative Biology. (Tampa, FL)
- Astley, H.C., Diaz, K., Mendelson III, J.M.R., Goldman, D.I. Sidewinding, Slithering, Sand, and Snakes; How complex substrates and surprising failures can lead to innovative locomotor solutions. (10/2018) Fall Central Sectional Meeting of the American Mathematical Society, Special Session on Bio-inspired Mechanics and Propulsion I, invited by Silas Alben. (Ann Arbor, MI)
- Astley, H.C. Traversing Tight Tunnels – Implementing an Adaptive Concertina Gait in a Biomimetic Snake Robot. (1/2018) Annual meeting of the Society for Integrative and Comparative Biology. (San Francisco, CA) (poster)
- Han, S.I., Astley, H.C. & Blackledge, T. Slingshot Motion of the *Hyptiotes* Spider Created by External Power Amplification in the Web. (1/2018) Annual meeting of the Society for Integrative and Comparative Biology. (San Francisco, CA)

- Howe, S. P. & Astley, H.C. Examining Turn Kinematics in Fish for the Control of Biomimetic Fish Robots. (1/2018) Annual meeting of the Society for Integrative and Comparative Biology. (San Francisco, CA)
- Garner, A.M., Keith, A.J., Schnarrenberger, A., Astley, H.C., Niewiarowski, P.H. The Effects of Running Orientation on Gecko Locomotor Performance. (1/2018) Annual meeting of the Society for Integrative and Comparative Biology. (San Francisco, CA) (poster)
- Astley, H.C. Biomimetic Replication of snake concertina locomotion. (10/2017). Midwest Regional Society for Integrative & Comparative Biology. (Akron, OH)
- Howe, S. P. & Astley, H.C. Exploring the kinematics of fish maneuvers. (10/2017). Midwest Regional Society for Integrative & Comparative Biology. (Akron, OH)
- Han, S.I., Astley, H.C. & Blackledge, T. External Power Amplification in the Web of *Hyptiotes cavatus*, the Triangle Spider. (10/2017). Midwest Regional Society for Integrative & Comparative Biology. (Akron, OH)
- Howe, S. P. & Astley, H.C. Exploring Fish New Wave: Understanding fish turn kinematics for the control of biomimetic fish robots. (10/2017) Nature-Inspired Exploration for Aerospace Summit 2017. (Cleveland, OH)
- Astley, H.C., Mendelson, J.R., & Goldman, D.I. Side-Impact Collision: Obstacle Negotiation Mechanics in Sidewinding Snakes. (1/2017) Annual meeting of the Society for Integrative and Comparative Biology. (New Orleans, LA)
- Herndon, C.J., Uzelac, I., Astley, H.C., & Fenton, F.H. Voltage and calcium dynamics in alligator hearts in comparison to mammals. (1/2017) Annual meeting of the Society for Integrative and Comparative Biology. (New Orleans, LA)
- Diaz Cruz, K., Astley, H.C., Mendelson, J.R., & Goldman, D.I. Undulation on granular media: a robophysical investigation. (1/2017) Annual meeting of the Society for Integrative and Comparative Biology. (New Orleans, LA)
- Camp, A.L., Astley, H.C., Horner, A.M., Roberts, T.J., & Brainerd, E.L. Fluoromicrometry: using X-ray video to measure the in vivo muscle dynamics of animal behaviors. (1/2017) Annual meeting of the Society for Integrative and Comparative Biology. (New Orleans, LA)
- Astley, H. C., McInroe, B., Gong, C., Kawano, S., Blob, R., Choset, H., and Goldman, D. I. Crucial advantages of tail use in the evolution of vertebrate terrestrial locomotion. 3/2016. March meeting of the American Physical Society. (Baltimore, MD)
- McInroe, B., Gong, C., Kawano, S., Astley, H. C., Blob, R., Choset, H., and Goldman, D. I. Robotic and mathematical modeling reveals principles of appendage coordination in terrestrial locomotion. 3/2016. March meeting of the American Physical Society. (Baltimore, MD)
- Schiebel, P.E., Zhang, T., Gong, C., Yu, M., Dai, J., Astley, H.C., Travers, M., Choset, H., Goldman, D.I. Slithering on sand: kinematics and controls for success on granular media. 3/2016. March meeting of the American Physical Society. (Baltimore, MD)
- Gong, C., Astley, H. C., Schiebel, P.E., Dai, J., Travers, M., Goldman, D.I., Choset, H. Geometric Mechanics Reveals Optimal Complex Terrestrial Undulation Patterns. 3/2016. March meeting of the American Physical Society. (Baltimore, MD)
- Astley, H. C., McInroe, B., Gong, C., Kawano, S., Blob, R., Choset, H., and Goldman, D. I. Crucial advantages of tail use in the evolution of vertebrate terrestrial locomotion.

1/2016. Annual meeting of the Society for Integrative and Comparative Biology. (Portland, OR)

- Reynaga, C.M., Astley, H. C., Azizi, E. Morphological and kinematic constraints of quadrupedal walking in frogs. 1/2016. Annual meeting of the Society for Integrative and Comparative Biology. (Portland, OR)
- Gong, C., Astley, H. C., Dai, J., McInroe, B., Schiebel, P.E., Travers, M., Goldman, D.I., Choset, H. Geometric Mechanics: A Framework for Studying Animal Locomotion. 1/2016. Annual meeting of the Society for Integrative and Comparative Biology. (Portland, OR)
- Schiebel, P.E., Zhang, T., Gong, C., Dai, J., Astley, H.C., Travers, M., Choset, H., Goldman, D.I. Slithering on sand: kinematics and controls for success on granular media. 1/2016. Annual meeting of the Society for Integrative and Comparative Biology. (Portland, OR)
- McInroe, B., Gong, C., Kawano, S., Astley, H. C., Blob, R., Choset, H., and Goldman, D. I. Robotic and mathematical modeling reveals principles of appendage coordination in terrestrial locomotion. 1/2016. Annual meeting of the Society for Integrative and Comparative Biology. (Portland, OR)
- Astley, H. C., Gong, C., Choset, H., and Goldman, D. I. Geometric Mechanics of Sidewinding. 11/2015. Atlanta Area Systems Biophysics Meeting. Atlanta, GA.
- Astley, H. C., McInroe, B., Gong, C., Kawano, S., Blob, R., Choset, H., and Goldman, D. I. Crucial advantages of tail use in the evolution of vertebrate terrestrial locomotion. 10/2015. South-Eastern Society for Integrative and Comparative Biology (regional meeting). Atlanta, GA.
- Lowder, M., Astley, H. C. and Goldman, D. I. Broad Comparative Study of Snake Locomotion on Sand. 10/2015. South-Eastern Society for Integrative and Comparative Biology (regional meeting). Atlanta, GA.
- McInroe, B., Gong, C., Kawano, S., Astley, H. C., Blob, R., Choset, H., and Goldman, D. I. Crucial advantages of tail use in the evolution of vertebrate terrestrial locomotion. 7/2015. Conference of the International Physics of Living Systems (iPoLS) Network. Washington, DC.
- Astley, H. C., Gong, C., Dai, J., Travers, M., Serrano, M. M., Vela, P., Choset, H., Mendelson, J., Hu, D. L., and Goldman, D. I. Independent modulation of orthogonal body waves enables versatile and rapid maneuverability in sidewinding. 3/2015. March Meeting of American Physical Society. (San Antonio, TX).
- McInroe, B., Astley, H.C., Kawano, S., Blob, R., Goldman, D.I. Animal and robot experiments to discover principles behind the evolution of a minimal locomotor apparatus for robust legged locomotion. 3/2015. March Meeting of American Physical Society. (San Antonio, TX).
- Astley, H. C., Gong, C., Travers, M., Serrano, M. M., Vela, P., Choset, H., Mendelson, J., Hu, D. L., and Goldman, D. I. Independent modulation of orthogonal body waves enables versatile and rapid maneuverability in sidewinding. 1/2015. Annual meeting of the Society for Integrative and Comparative Biology. (West Palm Beach, FL)
- McInroe, B., Astley, H.C., Kawano, S., Blob, R., Goldman, D.I. Biological and robotic modeling of the evolution of legged locomotion on land. 1/2015. Annual meeting of the Society for Integrative and Comparative Biology. (West Palm Beach, FL)

- Astley, H. C., Gong, C., Travers, M., Serrano, M. M., Vela, P., Choset, H., Mendelson, J., Hu, D. L., and Goldman, D. I. Independent modulation of orthogonal body waves enables versatile and rapid maneuverability in sidewinding. 10/2014. Southeastern regional meeting of the Society for Integrative and Comparative Biology. (Chapel Hill, N.C.)
- Astley, H. C., Gong, C., Serrano, M. M., Choset, H., Mendelson, J., Hu, D. L., and Goldman, D. I. Independent modulation of orthogonal body waves enables versatile and rapid maneuverability in sidewinding. 7/2014. International Meeting of the Physics of Living Systems Student Research Network. (Munich, Germany).
- McInroe, B., Astley, H.C., Kawano, S., Blob, R., Goldman, D.I. Using a robot to study the evolution of legged locomotion. 7/2014. International Meeting of the Physics of Living Systems Student Research Network. (Munich, Germany).
- McInroe, B., Astley, H.C., Kawano, S., Blob, R., Goldman, D.I. 3/2014. Using a robot to study the evolution of legged locomotion. March Meeting of American Physical Society. (Denver, CO).
- Astley, H.C., Serrano, M.M., Gong, C., Choset, H, Mendelson, J., Hu, D., and Goldman, D.I. 3/2014. Turning and maneuverability during sidewinding locomotion. March Meeting of American Physical Society. (Denver, CO).
- Astley, H.C., Serrano, M.M., Gong, C., Choset, H, Mendelson, J., Hu, D., and Goldman, D.I. 2/2014. Turning and maneuverability during sidewinding locomotion. Georgia Institute of Technology, Department of Physics, Physics of Living Systems seminar.
- McInroe, B. M., Astley, H. C., Kawano, S., Blob, R. and Goldman, D. I. 1/2014. Construction of a mudskipper-inspired robot to study crutching locomotion on flowable ground. Annual Meeting of the Society for Integrative and Comparative Biology. (Austin, TX).
- Astley, H.C. and T.J. Roberts. 1/2014. The mechanics of elastic loading and recoil in anuran jumping. Annual Meeting of the Society for Integrative and Comparative Biology. (Austin, TX).
- Astley, H.C. and T. J. Roberts. 10/2013. Performance, Mechanics and Diversity of Anuran Jumping. Georgia Institute of Technology, Department of Physics, Physics of Living Systems seminar.
- Astley, H.C. and T.J. Roberts. 1/2013. Where's the catch? Examining the catch mechanism in anuran jumping using inverse dynamics. Annual Meeting of the Society for Integrative and Comparative Biology. (San Francisco, CA).
- Astley, H.C. and T.J. Roberts. 1/2013. The diversity and evolution of locomotor muscle properties in anurans. Annual Meeting of the Society for Integrative and Comparative Biology. (San Francisco, CA).
- Astley, H.C. and T.J. Roberts. 11/2012. Where's the catch? Examining the catch mechanism in anuran jumping using inverse dynamics. Northeastern Regional Division of Vertebrate Morphology Meeting (SICB) (Amherst, MA).
- Astley, H.C. and T.J. Roberts. 06/2012. Biomechanics of frog jumping. XROMM course, Brown University.
- Astley, H.C. and T. J. Roberts. 4/2012. Performance, Mechanics and Diversity of Anuran Jumping. Brown University, Department of Ecology & Evolutionary Biology, Brown Bag seminar.



- Astley, H.C., Haruta, A. and Roberts, T.J. 1/2012. The Effects of Substrate Compliance on Jump Performance in the Cuban Tree Frog (*Osteopilus septentrionalis*). Annual Meeting of the Society for Integrative and Comparative Biology. (Charleston, SC).
- Horner, A.M., Astley, H.C. and Roberts, T.J. 1/2012. Analysis of rat hindlimb muscle and tendon mechanics using x-ray videoradiography. Annual Meeting of the Society for Integrative and Comparative Biology. (Charleston, SC).
- Astley, H.C., Haruta, A. and Roberts, T.J. 11/2011. The Effects of Substrate Compliance on Jump Performance in the Cuban Tree Frog (*Osteopilus septentrionalis*). Northeastern Regional Division of Vertebrate Morphology Meeting (SICB) (Kingston, RI).
- Astley, H.C. and T.J. Roberts. 07/2011. Decoupling of muscle shortening and joint kinematics in frog jumping. XROMM course, Brown University.
- Astley, H.C. 1/2011. Getting around when you're round: quantitative analysis of the locomotion of the thick-spined brittle star (*Ophiocoma echinata*). Annual Meeting of the Society for Integrative and Comparative Biology. (Salt Lake City, UT).
- Astley, H.C. 10/2010. Getting around when you're round: quantitative analysis of the locomotion of the thick-spined brittle star (*Ophiocoma echinata*). Northeastern Regional Division of Vertebrate Morphology Meeting (SICB) (Boston, MA).
- Astley, H.C. and T.J. Roberts. 8/2010. Decoupling of muscle shortening and joint kinematics in frog jumping. American Society of Biomechanics. (Providence, RI).
- Astley, H.C. and T.J. Roberts. 7/2010. Decoupling of muscle shortening and joint kinematics in frog jumping. Joint Meeting of Ichthyologists and Herpetologists. (Providence, RI).
- Astley, H.C., Abbott, E.M., Marsh, R.L., Azizi, E., Roberts, T.J. 7/2010. Measuring maximal animal performance with the celebrated jumping frogs of Calaveras County. Joint Meeting of Ichthyologists and Herpetologists. (Providence, RI).
- Astley, H.C., Abbott, E.M., Marsh, R.L., Azizi, E., Roberts, T.J. 7/2010. Measuring maximal animal performance with the celebrated jumping frogs of Calaveras County. Society for Experimental Biology (Prague, C.Z.)
- Astley, H.C. and T.J. Roberts. 06/2010. Decoupling of muscle shortening and joint kinematics in frog jumping. XROMM course, Brown University.
- Abbott, E.M., Marsh, R.L., Astley, H.C., Azizi, E., Roberts, T.J. 1/2010. The celebrated jumping frogs of Calaveras County: how far can a frog really jump? Annual Meeting of the Society for Integrative and Comparative Biology. (Seattle, WA).
- Astley, H.C. and T.J. Roberts. 1/2010. Decoupling of muscle shortening and joint kinematics in frog jumping. Annual Meeting of the Society for Integrative and Comparative Biology. (Seattle, WA).
- Astley, H.C. and T.J. Roberts. 10/2009. Decoupling of muscle shortening and joint kinematics in frog jumping. Northeastern Regional Division of Vertebrate Morphology Meeting (SICB) (Providence, RI).
- Astley, H.C. and T.J. Roberts. 09/2009. Decoupling of muscle shortening and joint kinematics in frog jumping. Workshop on Multi-Scale Muscle Mechanics, Woods Hole, MA.
- Astley, H.C. and T.J. Roberts. 08/2009. Decoupling of muscle shortening and joint kinematics in frog jumping. XROMM course, Brown University.

- Astley, H.C. and T.J. Roberts. 07/2009. Decoupling of muscle shortening and joint kinematics in frog jumping. Society for Experimental Biology (Glasgow, U.K.) (abstract in Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology. 153,2 (Suppl 1): S128)
- Astley, H.C. and B.C. Jayne. 01/2009. Arboreal habitat structure affects the performance and modes of locomotion of corn snakes (*Elaphe guttata*). Annual Meeting of the Society for Integrative and Comparative Biology. (Boston, MA).
- Astley, H.C. and B.C. Jayne. 08/2008. Arboreal habitat structure affects the performance and modes of locomotion of corn snakes (*Elaphe guttata*). Northeastern Regional Division of Vertebrate Morphology Meeting (SICB) (Storrs, CT).
- Astley, H.C. and B.C. Jayne. 10/2008. Effects of habitat structure on the arboreal locomotion of corn snakes (*Elaphe guttata*). Brown University, Department of Ecology & Evolutionary Biology, Brown Bag seminar.
- Astley, H.C. and B.C. Jayne. 01/ 2008. Effects of incline and surface width on the climbing performance in crevices versus on cylinders of corn snakes (*Elaphe guttata*). Annual Meeting of the Society for Integrative and Comparative Biology. (San Antonio, TX). Poster.
- Astley, H.C. and B.C. Jayne. 07/2007. Effect of perch diameter and incline on arboreal locomotion of snakes. Joint Meeting of Ichthyologists and Herpetologists. (St. Louis, MO).
- Astley, H.C. and B.C. Jayne. 01/ 2007. Effect of perch diameter and incline on arboreal locomotion of snakes. Annual Meeting of the Society for Integrative and Comparative Biology. (Phoenix, AZ).
- Astley, H.C., S.M. Locketto, B. Moskalik, and B.C. Jayne. 01/ 2006. Climbing without limbs: Arboreal locomotion of snakes. Annual Meeting of the Society for Integrative and Comparative Biology. (Orlando, FL).

## Media Coverage (selected):

### *Television/Radio*

WZIP radio interview, aired 6/8/19

Robots & Drones, Xploration Nature Knows Best, Season 2, Episode 7, Aired 10/21/17, Available on Hulu & Amazon Prime

Snake robots researched locally for rescue missions. Cleveland 19 News (WOIO), Aired 5/18/17. [URL](#)

Animalades – Terres Humides. RTVE (Spanish Public Broadcasting), December 30, 2015. [URL](#)

Interview with Dan Riskin on Brittle Star paper, Daily Planet, Discovery Channel Canada. May 17, 2012. [URL](#)

How Toads Land (with Laura Eckstrom (collaborator) and Dan Riskin (host)), Daily Planet, Discovery Channel Canada. October 16, 2012. [URL](#)

### *Print*

Snake locomotion and exhibit structures. Connect (publication of the Association of Zoos & Aquariums), August 2011.

A sea creature puts its best foot forward. New York Times, Science section, D3. May 14, 2012. [URL](#)

Star's five-legged coordination. Nature 485, 419 (24 May 2012) doi:10.1038/485419d [URL](#)

Motivating Your Frogs, Calaveras County Can Help. Inside JEB. 10/16/13. doi: 10.1242/jeb.095968 [URL](#)

A Ribbeting Tale. The Scientist, Volume 28 Issue 1, 1/2014. [URL](#)

Hop-a-long Strategy. New Scientist, pages 36-39. 5/10/14. [URL](#)

Secrets of the Sidewinder. New York Times. 10/9/14. [URL](#)

Of Snakes and Robots. Science 10 October 2014: Vol. 346 no. 6206 pp. 160-161 DOI: 10.1126/science.1259970 [URL](#)

Soft Catch Prepares Power for Frog Leaps. 12/17/2014 Inside JEB. 217, 4269-4270 [URL](#).

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*Ceratophrys cornuta* skeleton (skeletonized, mounted & photographed by HCA), in *Schmuckhornfrosche, Die Gattung Ceratophrys* by W. Schmidt & F. Henkel, 2011, p. 60, ISBN 978-3-86659-130-1