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PUBLICATION LIST
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Refereed Journal Articles:

*undergraduate co-authors

Hubel, T. Y., N. Hristov, S. M. Swartz, and K. S. Breuer. In review. The importance of morphology in force generation – a comparison of two insectivorous bat species. *Journal of the Royal Society Interface*.

Cheney, J. A., D. Ton*, N. Konow, D. K. Riskin, K. S. Breuer, and S. M. Swartz. In review. Hindlimb motion during steady flight of the lesser dog-faced fruit bat, *Cynopterus brachyotis. PLOS One*.

Von Busse, R., R. M. Waldman, S. M. Swartz, C. C. Voigt, and K. S. Breuer. In review. The aerodynamic cost of flight in bats comparing theory with measurement. *Journal of the Royal Society Interface*.

Bahlman, J. W., H. Lippe*, K. S. Breuer, and S. M. Swartz. In review. Simplifying a wing: diversity and functional consequences of digital joint reduction in bat wings. *Journal of Anatomy*.

Bahlman, J. W., S. M. Swartz, and K. S. Breuer. In review. How wing kinematics affect power requirements and aerodynamic force production in a robotic bat wing. *Bioinspiration and Biomimetics*.

Cheney, J. A., N. Konow, K. M. Middleton, K. S. Breuer, T. J. Roberts, E. L. GIblin, and S. M. Swartz. In Press. Membrane muscle function in the compliant wings of bats. *Bioinspiration and Biomimetics*.

Skulborstad, A., Y. Wang, J. Davidson, S. M. Swartz, and N. C. Goulbourne. 2013. Polarized image correlation for large deformation fiber kinematics. *Experimental Mechanics*. 53:1-9. doi: 10.1007/s11340-013-9751-4

Harper, C. J., S. M. Swartz and E. L. Brainerd. 2013. Specialized bat tongue is a hemodynamic nectar mop. *Proceedings of the National Academy of Sciences*. 110:8852-8857. doi/10.1073/pnas.1222726110

von Busse, R., S. M. Swartz, and C. C. Voigt. 2013. Flight metabolism in relation to speed in Chiroptera: Testing the U-shape paradigm in the short-tailed fruit bat, *Carollia perspicillata*. *Journal of Experimental Biology*. 216:2073-2080. doi:10.1242/jeb.081760

Bahlman, J. W., S. M. Swartz, and K. S. Breuer. 2013. Design and characterization of a multi-articulated robotic bat wing. *Bioinspiration and Biomimetics*. 8: 016009. doi:10.1088/1748-3182/8/1/016009

Curet, O.M., Swartz, S.M., Breuer, K.S., 2013. An aeroelastic instability provides a possible basis for the transition from gliding to flapping flight. *Journal of the Royal Society Interface* 10:20120940. doi.org/10.1098/rsif.2012.0940

Bahlman, J. W., S. M. Swartz, D. K. Riskin, and K. S. Breuer. 2012. Glide performance and aerodynamics of non-equilibrium glides in northern flying squirrels (*Glaucomys sabrinus*). *Journal of the Royal Society Interface* 10:20120794. doi.org/10.1098/rsif.2012.0794

Wang, Y., Son, S., Swartz, S. M., Goulbourne, N. C. 2012. A mixed Von Mises distribution for modeling soft biological tissues with two distributed fiber properties. *International Journal of Solids and Structures* 49: 2914-2923. 10.1016/j.ijsolstr.2012.04.004

Iriarte-Díaz, J., D. K. Riskin, K. S. Breuer, and S. M. Swartz. 2012. Kinematic plasticity during flight in fruit bats: individual variability in response to loading. *PLoS One* 7:e36665. doi:10.1371/journal.pone.0036665

Hubel, T. Y., N. I. Hristov, S. M. Swartz, and K. S. Breuer. 2012. Changes in kinematics and aerodynamics over a range of speeds in *Tadarida brasiliensis*, the Brazilian free-tailed bat. *Journal of the Royal Society Interface* 9:1120-1130. doi:10.1098/rsif.2011.0838

Riskin, D. K., A. J. Bergou, K. S. Breuer, and S. M. Swartz. 2012. Upstroke wing flexion and the inertial cost of bat flight. Proceedings of the Royal Society B – Biological Sciences 279:2945-2950. doi:10.1098/rspb.2012.0346

Bergou, A. J., S. M. Swartz, K. S. Breuer, and G. Taubin. 2011. 3D Reconstruction of bat flight kinematics from sparse multiple views. *IEEE International Conference on Computer Vision Theory*. doi:10.1109/ICCVW.2011.6130443

Willis, D. J., J. W. Bahlman, K. S. Breuer, and S. M. Swartz. 2011. Energetically optimal short range gliding trajectories for gliding animals. *AIAA Journal* 49:2650-2657.

Iriarte-Díaz, J., D. K. Riskin, D. J. Willis, K S. Breuer, and S. M. Swartz. 2011. Whole-body kinematics of a fruit bat reveal the influence of wing inertia on body accelerations. *Journal of Experimental Biology* 214:1546-1553. doi:10.1242/jeb.037804

MacAyeal, L. C.*, D. K. Riskin, S. M. Swartz, and K. S. Breuer. 2011. Vertical flight performance and load carrying in lesser dog-faced fruit bats (*Cynopterus brachyotis). Journal of Experimental Biology* 214:786-793. doi:10.1242/jeb.050195

Riskin, D. K., J. Iriarte- Díaz, K. M. Middleton, K. S. Breuer, and S. M. Swartz. 2010. The effect of body size on the wing movements of pteropodid bats, with insights into thrust and lift production. *Journal of Experimental Biology* 213:4110-4122. doi: 10.1242/jeb.043091

Hubel, T. Y., D. K. Riskin, S. M. Swartz, and K. S. Breuer. 2010. Wake structure and wing kinematics: the flight of the lesser dog-faced fruit bat, *Cynopterus brachyotis*. *Journal of Experimental Biology* 213: 3427-3440. doi:10.1242/jeb.043257

Chen, J., D. K. Riskin, T. Y. Hubel, D. J. Willis, A. Song, H. Liu, K. S. Breuer, S. M. Swartz, and D. H. Laidlaw. 2010. Exploration of bat wing morphology through a strip method and visualization. *Special Interest Group on Graphics and Interactive Techniques SIGGRAPH Talks* 2010. doi: 10.1145/1837026.1837039.

Middleton, K. M., B. D. Goldstein*, P. R. Guduru, J. F. Waters, S. A. Kelly, S. M. Swartz and T. Garland, Jr. 2010. Variation in within-bone stiffness measured by nanoindentation in mice bred for high levels of voluntary wheel running. *Journal of Anatomy* 216:121-131. doi: 10.1111/j.1469-7580.2009.01175.x

Chen, J., M. Kostandov, I. V. Pivkin, D. K. Riskin, S. M. Swartz, and D. H. Laidlaw. 2009. Visual analysis of dimensionality reduction in an interactive virtual environment for exploring bat flight kinematics. *Joint Virtual Reality Conference of EGVE-ICAT-EUROVR* 2009:77-84. doi: 10.2312/EGVE/JVRC09/077-084

Riskin, D. K., J. W. Bahlman, T. Y. Hubel, J. M. Ratcliffe, T. H. Kunz, and S. M. Swartz. 2009. Bats go head-under-heels: The biomechanics of landing on a ceiling. *Journal of Experimental Biology* 212:945-953. doi: 10.1242/jeb.026161

Hubel, T. Y., N. I. Hristov, S. M. Swartz, and K. S. Breuer. 2009. Time-resolved wake structure and kinematics of bat flight. *Experiments in Fluids* 46:933-943. doi 10.1007/s00348-009-0624-7

Keefe, D. F., D. Acevedo, D., J. Miles, F. Drury, S. M. Swartz, and D. H. Laidlaw. 2008. Scientific sketching for collaborative VR visualization design. IEEE Transactions on Visualization and Computer Graphics 14, 835-847. doi:10.1109/TVCG.2008.31

Waldman, R. M., A. Song, D. K. Riskin, S. M. Swartz, and K. S. Breuer. 2008. Aerodynamic behavior of compliant membranes as related to bat flight. American Institute of Aeronautics and Astronautics Journal: AIAA no. 2008-3716.

Riskin, D. K., D. J. Willis, T. L. Hedrick, J. Iriarte-Díaz, M. Kostandov, J. Chen, D. H. Laidlaw, K. S. Breuer, and S. M. Swartz. 2008. Quantifying the complexity of bat wing kinematics. *Journal of Theoretical Biology* 254: 604–615. doi: 10.1016/j.jtbi.2008.06.011

Iriarte-Díaz, J. and S. M. Swartz. 2008. Kinematics of slow turn maneuvering in the fruit bat *Cynopterus brachyotis*. *Journal of Experimental Biology* 211 3478-3489. doi:10.1242/jeb.017590

Kunz, T. H., S. A. Gauthreaux, Jr, N. I. Hristov, J. W. Horn, G. Jones, E. K. V. Kalko, R. P. Larkin, G. F. McCracken, S. M. Swartz, R. B. Srygley, R. Dudley, J. K. Westbrook, and M. Wikelski. 2008. Aeroecology: probing and modeling the aerosphere. *Integrative and Comparative Biology* 8: 1-11. doi:10.1093/icb/icn037

Swartz, S. M. D. J. Willis, and K. S. Breuer. 2008. Aeromechanics in aeroecology: Flight biology in the aerosphere. *Integrative and Comparative Biology* 48: 85-98. doi: 10.1093/icb/icn054

Song, A, X. Tian, E. Israeli*, R. Galvao*, Bishop, S. Swartz, and Breuer, K. 2008. Aeromechanics of membrane wings with implications for animal flight. *AIAA Journal* 46:2096-2196. doi: 10.2514/1.36694

Middleton, K.M., C.E. Shubin*, D.C. Moore, T. Garland, Jr., P.A. Carter, and S.M. Swartz. 2008. The relative importance of genetics and phenotypic plasticity in dictating bone morphology and mechanics in aged mice: Evidence from an artificial selection experiment. *Zoology* 111: 135-147. doi:10.1016/j.zool.2007.06.003

Swartz, S. M. and Middleton, K. M. 2008. Biomechanics of the bat limb skeleton: scaling, material properties and mechanics. Cells Tissues Organs, 187: 59-84. doi: 10.1159/000109964.

Willis, D. J., E. Israeli, P. Persson, M. Drela, and J. Peraire, S. M. Swartz and K. S. Breuer. 2007. A computational framework for fluid structure interaction in biologically inspired flapping flight. *American Institute of Aeronautics and Astronautics Applied Aerodynamics* 25: 3803-3809.

Willis, D. J., M. Kostandov, D. K. Riskin, J. Peraire, D. H. Laidlaw, S. M. Swartz, K. S. Breuer. 2007. Modeling the flight of a bat: First Place, Informational Graphics, International Visualization Competition. *Science* 317:1860. doi: 10.1126/science.1133598

Swartz, S. M., J. Iriarte-Díaz, D. K. Riskin, A. Song, X. Tian, D. J. Willis, and K.S. Breuer. 2007. Wing structure and the aerodynamic basis of flight in bats. *American Institute of Aeronautics and Astronautics Aerospace Sciences* 45: 22-26.

Chen, J., A. Forsberg, S. M. Swartz, and D. H. Laidlaw. Interactive multiple scale small multiples. *IEEE Visualization 2007 Poster Compendium*, November 2007.

Kostandov, M., I. Pivkin, K. Breuer, S. M. Swartz, and D. H. Laidlaw. 2006. Proper orthogonal decomposition and particle image velocimetry in bat flight. *IEEE Visualization 2006 Poster Compendium*. November 2006.

Tian, X., Iriarte-Díaz, J, Middleton, K, Galvao*, R, Israeli*, E, Roemer*, A, Sullivan*, A, Song, S. M. Swartz and K. S. Breuer. 2006. Direct measurements of the kinematics and dynamics of bat flight. *Bioinspiration and Biomimetics*. 1:10-18. doi:10.1088/1748-3182/1/4/S02

Pivkin, I., E. Hueso, R. Weinstein*, D. H. Laidlaw, S. Swartz, and G. Karniadakis. 2005. Simulation and visualization of air flow around bat wings during flight. *Proceedings of International Conference on Computational Science*, 689-694.

Sobel, J. S., A. S. Forsberg, D H. Laidlaw, R. C. Zeleznik, D. F. Keefe, I. Pivkin,G. E. Karniadakis, S. M. Swartz, and P. Richardson. 2004. Particle flurries: synoptic 3D pulsatile flow visualization. *IEEE Computer Graphics and Applications* April/May: 2-11. doi: 10.1109/MCG.2004.1274065

Hueso, E., I. V. Pivkin, S. M. Swartz, D. H. Laidlaw, G. Karniadakis, and K. S. Breuer. 2004. Visualization of vortices in simulated airflow around bat wings during flight. *IEEE Visualization 2004 Poster Compendium*, October 2004. doi.ieeecomputersociety.org/10.1109/VISUAL.2004.118

Watts, P., E. J. Mitchell*, and S. M. Swartz. 2001. A computational model for estimating mechanics of horizontal flapping flight in bats. Model description and comparison with experimental results. *Journal of Experimental Biology* 204: 2873-2898.

Swartz, S. M., A. Parker*, and C. Huo*. 1997. Theoretical and empirical scaling patterns and topological homology in bone trabeculae. *Journal of Experimental Biology* 201:573-590.

Swartz, S. M. 1997. Allometric patterning in the limb skeleton of bats: Implications for the mechanics and energetics of powered flight. *Journal of Morphology* 234:277-294.

Papadimitriou, H. M. *, S. M. Swartz, and T. H. Kunz. 1996. Ontogenetic and anatomic variation in mineralization of the wing skeleton of the Mexican free-tailed bat, *Tadarida brasiliensis*. *Journal of Zoology, London* 240:411-426.

Swartz, S. M., M. D. Groves*, H. D. Kim* and W. R. Walsh. 1996. Mechanical properties of bat wing membrane skin: aerodynamic and mechanical functions. *Journal of Zoology, London* 239:357-378.

Halgrimmsson, B.* and S. M. Swartz. 1995. Morphological adaptation in the hylobatid ulna: cross-sectional geometry and skeletal loading. *Journal of Morphology* 224:111-123.

Swartz, S. M., M. B. Bennett, and D. R. Carrier. 1992. Wing bone stresses in free flying bats and the evolution of skeletal design for flight. *Nature* 359:726-729.

Anton, S. C*., C. R. Jaslow and S. M. Swartz. 1992. Sutural complexity in artificially deformed human (*Homo sapiens*) crania. *Journal of Morphology* 214:321-322.

Bertram, J. E. A. and S. M. Swartz. 1991. The "Law of bone transformation": A case of crying Wolff? *Biological Reviews of the Cambridge Philosophical Society* 22:245-273.

Swartz, S. M. 1991. Strain analysis as a tool for functional morphology. *American Zoologist* 31:655-669.

Swartz, S. M. 1990. Pendular mechanics and the kinematics and energetics of brachiating locomotion. *International Journal of Primatology* 10:387-418.

Swartz, S. M. 1990. Curvature of the limb bones of anthropoid primates: overall allometric patterns and specializations in suspensory species. *American Journal of Physical Anthropology* 83:477-498.

Swartz, S. M. 1989. The functional morphology of weight bearing: limb joint surface area allometry in anthropoid primates. *Journal of Zoology, London* 218:441-460.

Swartz, S. M., A. A. Biewener, and J. E. A. Bertram. 1989. Telemetered *in vivo* strain analysis of locomotor mechanics of brachiating gibbons. *Nature* 342:270-272.

Swartz, S. M. 1987. Skeletal biomechanics and suspensory locomotion: preliminary results of *in vivo* bone strain analysis of brachiating gibbons. *Proceedings of the American Society of Biomechanics* 3:151-153.

Biewener, A. A., S. M. Swartz and J. E. A. Bertram. 1986. Bone modeling during growth: dynamic strain equilibrium in the chick tibia. *Calcified Tissue International* 39:390-395.

Chapters in Books:
*undergraduate co-authors

Swartz, S. M., J. Iriarte-Díaz, D. K. Riskin, and K S. Breuer. 2012. A bird? a plane? No, it's a bat: an introduction to the biomechanics of bat flight. In *Evolutionary History of Bats: Fossils, Molecules and Morphology* (G. Gunnell and N. B. Simmons, eds). pp. 317-352. Cambridge University Press, Cambridge, UK.

Albertani R, T. Y. Hubel, S. M. Swartz, K. S. Breuer, and J. Evers. 2011. In-flight wing-membrane strain measurements on bats. In: Proulx, T. (ed) *Experimental and Applied Mechanics*. pp. 437-455. Springer, New York.

Dumont, E. L. and S. M. Swartz. 2009. Biomechanical approaches and ecological research. In *Ecological and Behavioral Methods for the Study of Bats* (T. H. Kunz, ed.) pp. 436-458. Johns Hopkins University Press, Baltimore, MD.

Swartz, S. M., Bishop, K. L., and Ismael-Aguirre, M. F.* 2005. Bat flight aerodynamics: new insights from three-dimensional kinematic analysis. In *Functional and Evolutionary Ecology of Bats* (Z. Akbar, G. F. McCracken, and T. H. Kunz, eds) pp. 110-121. Oxford University Press, Oxford, UK.

Swartz, S. M., P. Freeman, and E. Stockwell. 2003. Ecomorphology. in *Bat Ecology*. (T. H. Kunz, ed.) pp. 257-300. The University of Chicago Press, Chicago, IL.

Swartz. S. M. 1998. Skin and bones: the mechanical properties of bat wing tissues. in *Bats: Phylogeny, Morphology, Echolocation, and Conservation Biology*. (T. H. Kunz and P. A. Racey, eds.) Smithsonian Institution Press, Washington, D. C.

Swartz, S. M. and A. A. Biewener. 1992. Shape and scaling. in *Biomechanics: A Practical Approach*. Vol. 2. Structures. (A. A. Biewener, ed.). pp. 20-43. Oxford University Press, Oxford, UK.

Swartz, S. M. 1993. The biomechanics of primate limbs. in *Postcranial Adaptation in Nonhuman Primates* (D. L. Gebo, ed.) pp. 542. Northern Illinois University Press, De Kalb, IL.

Swartz, H. M. and S. M. Swartz. 1983 Biochemical and Biophysical Applications of Electron Spin Resonance. in *Methods of Biochemical Analysis*, volume 29, D. Glick, ed. pp. 207-323. John Wiley and Sons, Inc., New York.

Non-refereed Journal Articles:

Weinstein*, R. I. Pivkin, S. Swartz, D. H. Laidlaw, G. Karniadakis, and K. Breuer. Simulation and visualization of air flow around bat wings during flight. Technical Report CS-02-16, Brown University Computer Science Department, August 2002.

Book Reviews:

Flying squirrels and their ilk: Art and science for the coffee table. A review of Gliding Mammals of the World by Stephen Jackson, Illustrated by Peter Schouten, CSIRO Publishing, 2012. *Journal of Mammalian Evolution* doi: 10.1007/s10914-013-9235-4

Prime Mover; a Natural History of Muscle by Steven Vogel. Norton, New York, 2002. *Science* 295:1650-1651.

Taking Wing: Archaeopteryx and the Evolution of Bird Flight, by Pat Shipman. Simon and Schuster, New York, 1998. *Science* 281(5375):355-356.

A Theory of Human and Primate Evolution, by Colin P. Groves. Clarendon Press, Oxford, 1989. *International Journal of Primatology* 1990, 11:607-609.

Meeting Abstracts, 2009 – present

2014:

AIAA Science and Technology Forum and Exposition 2014:

Chen, P-T., S. Joshi, S. Swartz, K. Breuer, G. Reich. Bat-inspired flapping flight.

Society for Integrative and Comparative Biology:

Bahlman, J. W., K. S. Breuer, and S. M. Swartz. Diversity and functional consequences of reducing synovial joints in bat wings.

Cheney, J. A., A. Bearnot, S. M. Swartz. Bat wing skin mechanical behavior.

Dumont E, W. Pineda, B. Baird, O. Warsi, A. Smith, S. M. Swartz S, L. Dávalos. Rates of evolution in the crania and wings of phyllostomid bats.

Konow, N., Roberts, T. J., D. Boerma, R. von Busse, S. M. Swartz. Mechanics of proximal limb muscle tendon units in a small flying mammal.

Sample, C. S., A. Xu, S. M. Swartz, L. J. Gibson. Nanomechanical properties of insect wing layers.

Schunk, C., K. Michaelson, T. Paine, S. M. Swartz, K. S. Breuer. The effect of aspect ratio on the generation of lift and drag of bat-like flapping wings.

Society for Experimental Biology:

Mechanics and energetics of bat flight: theory, measurement, and ecological implications; Invited Symposium Talk.

2013:

Society for Integrative and Comparative Biology:

Bahlman, J. W., S. M. Swartz, and K. S. Breuer. The cost of performance: power cost and aerodynamic force generated by varying wingbeat kinematics.

Bergou, A. J., J. Franck, L., G. Taubin, S. M. Swartz, and K. S. Breuer. How do bats turn?

Cheney, J. A., K. M. Middleton, N. Konow, E. L. Giblin, K.S. Breuer, and S. M. Swartz. Electromyography of bat wing muscles.

Konow, N., R. von Busse, J. A. Cheney, K. S. Breuer, S. M. Swartz. What is the relationship between pectoralis muscle recruitment intensity and air speed velocity in an un-laden bat?

Schunk, S., C. Chiu, S. M. Swartz, and K. S. Breuer. Velocity fields in the near-wake of *E. fuscus*.

Von Busse, J. R. S., M. Mostowy, H. Bruce, and S. M. Swartz. Kinematics of swimming and flying big brown bats, *Eptesicus fuscus* - a comparative study.

Society for Experimental Biology:

Konow, N. von Busse, T. J. Roberts, S. M. Swartz. Can bat wing muscles stretch their tendon to enable force control of joint movement?

International Congress on Vertebrate Morphology:

Konow, N., R. von Busse, T. J. Roberts, S. M. Swartz. Can bat wing muscles operate as force controllers?

Swartz, S. M., R. von Busse, R. Waldman, N. Konow, C. C. Voigt, K. S. Breuer. Integrating aerodynamics and energetics to understand how bats change flight dynamics with speed.

International Bat Research Congress:

Bahlman, J. W., K. S. Breuer, and S. M. Swartz. Simplifying a wing: diversity and functional consequences of reducing joints in bat wings.

Dumont E, W. Pineda, B. Baird, O. Warsi, A. Smith, S. M. Swartz S, L. Dávalos. Rates of evolution in the cranial and postcranial skeletons of phyllostomid bats.

American Physical Society:

Schunk, C., K. Michaelson, T. Paine, S. M. Swartz, K. S. Breuer. The effect of aspect ratio on the generation of lift and drag of a compliant membrane flapping wing.

2012:

Society for Integrative and Comparative Biology:

Bahlman, J. W., S. M. Swartz, and K. S. Breuer. Measuring cost of flight associated with varying kinematics in a robotic bat wing.

Bergou, A. J., J. Franck, L. Reimnitz, D. K. Riskin, G. Taubin, S. M. Swartz, and K. S. Breuer. Inertial and fluid forces during bat flight maneuvers.

Bergou, A. J., S. M. Swartz, K. S. Breuer, and G. Taubin. 3D Reconstruction and analysis of bat flight maneuvers from sparse multiple view video.

Chiu, C., K. S. Breuer, and S. M. Swartz. The interactive flight of bats.

Harper, C. J., S. M. Swartz, and E. L. Brainerd. How nectar-feeding bats lap: nectar uptake and ingestion in *Glossophaga soricina*.

Von Busse, J. R. S., S. M. Swartz, K. S. Breuer, A. Hedenström, Y. Winter, and C. C. Voigt. Energetics of bat flight.

Cheney, J. A., A. Bearnot*, K. S. Breuer, S. M. Swartz. Pre-stressed compliant fibers within the wing membrane of *Glossophaga soricina*, Pallas' long tongued bat.

American Physical Society:

Waldman, R. M., R. von Busse, S. M. Swartz, and K. S. Breuer. The aerodynamic cost of flight in bats---comparing theory with measurement.

2011:

Society for Integrative and Comparative Biology:

Bahlman, J. W., S. M. Swartz, and K. S. Breuer. Measuring performance associated with increasing kinematic complexity in a robotic bat wing.

Bergou, A., D. K. Riskin, G. Taubin, S. M. Swartz, and K. S. Breuer. "Falling with style" - the role of wing inertia in bat flight maneuvers.

Chadwell, B. A., N. I. Hristov, L. C. Allen, K. S. Breuer, and S. M. Swartz. Methods for describing and analyzing group behavior in bats: a case study in the Brazilian free-tailed bat.

Cheney, J. A., A. Bearnot*, K. S. Breuer, S. M. Swartz. Form and function in the wing membrane of bats.

Harper, C. J., E. L. Brainerd, and S. M. Swartz. The morphology of the free portion of the tongue in a nectar-feeding bat, *Glossophaga soricina*.

Hristov, N. I., T. L. Hedrick, L. C. Allen, B. A. Chadwell, T. H. Kunz, K. S. Breuer, and S. M. Swartz. Flight formation and group behavior in the highly gregarious Brazilian free-tailed bat *Tadarida brasiliensis*.

Schunk C., C. Chiu, J. W. Bahlman, A. Bergou, J. Cheney, R. M. Waldman, O. Curet, E. Albright*, S. M. Swartz, and K. S. Breuer. Time-resolved measurements of the velocity field over the wing of a bat during flight.

Swartz, S. M., and K. S. Breuer. How can bats inspire robotic fliers and micro air vehicles?

Ecological Society of America:

Hristov, N., S. Swartz, M. Betke, and T. H. Kunz. Integrating novel technologies to understand the fight behavior of bats at different temporal and spatial scales.

AIAA Fluid Dynamics Conference and Exhibit:

Curet, O. M., S. M. Swartz, and K. S. Breuer, K. S. A self-excited flapping wing: lift, drag and the implications for biological flight.

Schunk, C., J. Bahlman, S. Swartz and K. Breuer Measurement of the wake behind a bat-like flapper and the influence of the flapping frequency on lift generation.

IEEE ICCV Workshop on Dynamic Shape Capture

Bergou, A. J., S. M. Swartz, K. S. Breuer, and G. Taubin. 3D reconstruction of bat flight kinematics from sparse multiple views.

IEEE Symposium on Biological Data Visualization

Bergou, A. J., S. M. Swartz, K. S. Breuer, and G. Taubin. 3D reconstruction and analysis of bat flight maneuvers from sparse multiple view video.

American Physical Society:

Bergou, A. J., J. Franck, G. Taubin, S. Swartz, and K. Breuer. Inertial and fluid forces during bat flight maneuvers.

Curet, O., S. Swartz, and K. Breuer. Lift force enhancement and fluid-structure interactions on a self-excited flapping wing model.

Franck, J., S. Swartz, and K. Breuer. Large-Eddy Simulations of flapping-induced lift enhancement.

Schunk, C., S. Swartz and K. Breuer. Time-resolved measurements of the velocity field over the wing of bats during flight.

Waldman, R., S. Swartz, K. Breuer. Fluid-structure interactions on compliant membrane wings.

2010:

Society for Integrative and Comparative Biology:

Bahlman, J. W., C. Schunk*, S. M. Swartz, and K. S. Breuer. The effect of wingbeat frequency on aerodynamic force and wake structure using a bat-like mechanical flapper.

Cheney, J. A., D. Ton*, D. K. Riskin, and S. M. Swartz. Hindlimb movement of *Cynopterus brachyotis* during flight.

Harper, C. J., E. Azizi, B. N. Nowroozi, A. C. Sullivan, and S. M. Swartz. Hovering and hoovering: tongue and wing movements in nectar-feeding bats *Glossophaga soricina*.

Hristov, N. I., D. K. Riskin, T. Y. Hubel, L. C. Allen, K. S. Breuer, and S. M. Swartz. Kinematics of a fast bat: Changes in wing kinematics with flight speed in the migratory bat (*Tadarida brasiliensis*)

Hubel, T. Y., N. I. Hristov, D. K. Riskin, S. M. Swartz, and K. S. Breuer. Bat flight and hierarchies of variability.

MacAyeal, L. C.*, D. K. Riskin, S. M. Swartz, and K. S. Breuer. Vertical climbing performance and reserve power in loaded and unloaded Lesser Dog-faced Fruit Bats (*Cynopterus brachyotis*).

Riskin, D. K., J. Iriarte-Díaz,, K. M. Middleton, K. S. Breuer, and S. M. Swartz. How do bats accelerate?

American Physical Society:

Bergou, A., D. K. Riskin, G. Taubin, S. M. Swartz, and K. S. Breuer. "Falling with style" - bat flight maneuvers.

Society for Experimental Biology:

Hubel, T. Y., D. K. Riskin, S. M. Swartz, and K. S. Breuer. The flight of the lesser short-nosed fruit bat.

International Bat Research Symposium:

Hristov, N. I., M. Betke, K. S. Breuer, S. M. Swartz, T. H. Kunz. Scales of movement by a long-distance migrant: the Brazilian free-tailed bat (*Tadarida brasiliensis*).

Hubel, T. Y., N. I. Hristov, D. K. Riskin, S. M. Swartz, K. S. Breuer. The aerodynamics of different bat species.

Swartz, S. M., J. A. Cheney, A. Bearnot*, J. W. Bahlman, H. Lippe*, D. K. Riskin. Mechanics of soft tissue wing structures and the flight of bats.

North American Bat Research Symposium:

Bahlman, J. W., H. Lippe*, E. Albright*, S. M. Swartz. Comparing the Anatomy and Kinematics of Bat Handwings.

Harper, C. J., E. L. Brainerd, and S. M. Swartz. The morphology of muscles, connective tissues, and vasculature along the length of the tongue in a nectar-feeding bat, *Glossophaga soricina*.

2009:

Society for Integrative and Comparative Biology:

Bahlman, J. W., D. K. Riskin, J. Iriarte-Díaz, and S. M. Swartz. Aerodynamics of the northern flying squirrel (*Glaucomys sabrinus*).

Chen, J., D. K. Riskin, K. S. Breuer, S. M. Swartz, and D. H. Laidlaw. Bookstein-coordinate-based shape analysis of bat wing kinematics.

Dickinson, B. T., S. M. Swartz, and B. A. Batten. A mathematical model of the detection of unsteady flow separation by hairs on a bat wing.

Iriarte-Díaz, J., D. K. Riskin, and S. M. Swartz. No net thrust on the upstroke: the effect of wing inertia on body accelerations of fruit bats during flight.

Hubel, T. Y., K. S. Breuer, and S. M. Swartz. Individual variability in the aerodynamics and kinematics of bat flight

Kunz, T. H., M. Muñoz-Romo, E. R. Dumont, D. K. Riskin, and S. M. Swartz. Non-flight use of wings by bats.

Mostafiz, W*., N. Gidmark, and S. M. Swartz. Histology and morphology of cyprinid pharyngeal dentition in relation to diet.

Middleton, K.M., M. Conners*, and S. M. Swartz. Variation in rachis cross-sectional geometry within and among flight feathers in the Barn Owl (*Tyto alba*).

Riskin, D K., J. W. Bahlman, T. Y. Hubel, J. M. Ratcliffe, T. H. Kunz, and S. M. Swartz. Oh what a feeling: the kinematics and kinetics of landing on a ceiling.

Swartz, S. M., D. K. Riskin, J. Iriarte-Díaz, K. M. Middleton, and K. S. Breuer. Scaling of flight characteristics in bats.

Willis, D.J., D. K. Riskin, S. M. Swartz, J. Peraire, K. S. Breuer. Computational modeling of the aeromechanics of a bat (*Cynopterus brachyotis*).

North American Bat Research Symposium:

Cheney, J. A., D. Ton, D. K. Riskin, and S. M. Swartz. Don't forget the legs: hindlimb movement of *Cynopterus brachyotis* during flight.

Evans, A., J. A. Cheney, and S. M. Swartz. Material properties of *Glossophaga soricina* wing membrane.

Hristov, N. I., D. K. Riskin, T. Y. Hubel, L. C. Allen, K. S. Breuer, and S. M. Swartz. How do fast bats fly: Wing kinematics of the Brazilian free-tailed bat (*Tadarida brasiliensis*) flying at a range of flight speeds.

Hubel, T. Y., N. I. Hristov, K. S. Breuer, and S. M. Swartz. How different is the flight of different bat species?

Invited Lectures, 2009-present only:

University of Washington, Department of Biology

Northeast Ohio Medical University

NSF- US Army Research Office Interdisciplinary Workshop on Bio-Inspired Robotics: *Why are animals better?*

Northeastern University

University of Western Ontario

Brown Distinguished Speaker Summer @Brown series

AFOSR-ONR Bio-Inspired Autonomous Systems Workshop, Arlington, VA

University of California – Riverside

California State University – San Bernardino

NextGen Aeronautics, Torrance, CA

Reconfigurable multifunctional systems: Bio-inspired active materials & morphing structures, Hokkaido University, Japan (co-sponsored with University of Washington, Army Research Office, and AFOSR)

University of Southern California, College Commons Colloquium

Lund University, Sweden, Department of Theoretical Ecology

Air Force Office of Scientific Research Annual Research Highlights

NSF Workshop: Interdisciplinary workshop on linking Engineering to Biology (four day special workshop)

Lubee Bat Conservancy, Gainesville, FL

Cornell University, Machines and Organisms Seminar

Boston University, Department of Biology

Air Force Office of Scientific Research, Arlington Virginia

Private briefing for Dr. Mark Lewis, Chief Scientist of the Air Force, Pentagon

Göteborg University, Department of Zoology, Sweden

Current Research Grants:

Air Force Office of Scientific Research: High Speed Kinematics and Velocimetry Equipment for Biological and Cyber-Physical Studies, Defense University Research Instrumentation Program (co-PI, with K. Breuer, PI and S. Mandre, co-PI, School of Engineering, and T. Roberts, co-PI). $ 520K.

National Science Foundation: Collaborative Research: Structure and Mechanics of the Bat Wing Membrane, from Directorate for Biology, Integrative Organismal Systems Program (PI, with N. Goulbourne, University of Michigan, co-PI). $666K.

Air Force Office of Scientific Research: Dynamics of Bat Wing Musculature, from Sensory Information Systems Program (PI, with T. Roberts, co-PI). $1,224K

Air Force Office of Scientific Research: Aerodynamics and Mechanics of Flight Robusticity in Bats: Animal Flight and Physical Model Experiments for Flapping MAV Applications, from Flow Interactions and Control Program (PI, with K. Breuer, School of Engineering, co-PI), $517K

Completed Research Grants:

2010-2013: Air Force Office of Scientific Research, Multi University Research Initiatives (MURI): "Supplement to Biologically Inspired Flight for Micro Air Vehicles" (K. Breuer, PI, Co-PI with C. Moss (U. Maryland). $282K.

2009-2011: Air Force Office of Scientific Research: "Reconfigurable, Hovering, Ultra-Maneuverable Bat Technologies (RHUMBAT" (co-PI with co-PIs S. Joshi, NextGen Aeronautics, G. Reich, Wright-Patterson Air Force Base, and N. Goulbourne, Virginia Tech), $750K.

2009-2011 Air Force Office of Scientific Research Defense University Research Instrumentation Program (DURIP): "Acquisition of an Advanced Thermal Infrared Imaging System for Tracking Multiple Targets in Three Dimensions" (co-PI with T. Kunz, PI, Boston University). $525,000.

2008-2011 NSF ADVANCE Career Development Award: "Skins of 'Bone': The Mechanics and Structural Design of the Insect Exoskeleton. $20K.

2007-2012 Air Force Office of Scientific Research, Multi University Research Initiatives (MURI): "Biologically Inspired Flight for Micro Air Vehicles" (K. Breuer, PI, Co-PI with M. Drela and J. Peraire (MIT), C. Moss (U. Maryland), and B. Batten (Oregon State University). $6,200K

2007-2011 Keck Foundation: "Phase II Proposal: A Proposal to Design and Build a Dynamic Skeletal Imaging System" (PI: E. Brainerd) $1,800K

2007-2010 National Science Foundation: Bat Wing Structure and the Aerodynamic Mechanisms of Flapping Flight. (D. Laidlaw and K. Breuer, co-PIs). $280K.

2006 Department of Defense, Defense University Instrumentation Program: "High-speed Motion Analysis and Particle Velocimetry System for Studies in Maneuvering Flight in Bats" (PI, K. Breuer co-PI) $488K

2006 Air Force Office of Scientific Research: "Supplement to Aeromechanics of Highly Maneuverable Bats" (PI, K. Breuer co-PI) $85K

2005-2008 Air Force Office of Scientific Research: "Aeromechanics of Highly Maneuverable Bats" (PI, K. Breuer co-PI) $450K

2005-2008 National Research Service Award to Kevin Middleton (Sponsor) $100K

2005-2007 National Science Foundation: "DDDAS-TMRP: Interactive Data-driven Flow-simulation Parameter Refinement for Understanding the Evolution of Bat Flight" (D. Laidlaw, PI, co-PI with K. Breuer) $150K

2004-2009 National Science Foundation: "Computational simulation, modeling, and visualization for understanding unsteady bioflows". (co-PI with D. Laidlaw, G. Karniadakis, and P. Richardson) $650K

2004-2006 National Science Foundation: “DISSERTATION RESEARCH: Gliding Aerodynamics and the Origin of Bat Flight” (PI, co-PI graduate student Kristin Bishop) $10K

2004-2005 Brown University Salomon Research Fund: “Aerodynamic mechanisms of bat flight: an integrated multidisciplinary approach (PI with co-PIs K. Breuer and D. Laidlaw); $20K

2003 National Science Foundation, MRI Program: “A volumetric imaging system for reconstruction of macroscopic fluid flows in organismic biology” (co-Investigator with G. Lauder, A. Biewener, N. Holbrook and H. Stone, Harvard University, and C. Wilga, University of Rhode Island) $130K

2002-2003 National Science Foundation, CCLI Program: “Context-Rich Interactive Science Teaching and Learning System” (co-PI with Thomas Webb, III, David Cutts, David Targan, and Nancy Pollard). $74K

2002-2003 NASA Space Grant Scholarship support to undergraduate research student Noa Kay, $3K

2000-2003 National Science Foundation: "Aerodynamics, Wing Biomechanics, and the Evolutionary Diversification of the Chiroptera". (PI) $434K

1999-2000 National Science Foundation: "Aerodynamics, Wing Biomechanics, and the Evolutionary Diversification of the Chiroptera". (PI) $279K

1997-1999 National Science Foundation: "Aerodynamics, Wing Biomechanics, and the Evolutionary Diversification of the Chiroptera". (PI) $73K

1996-1997 National Science Foundation: "The Biomechanics of Bat Flight: Skeletal architecture and functional performance". (PI) $190K

1995-1997 Whitaker Foundation: "New biomechanical approaches to understanding plasticity and functional significance in trabecular bone architecture". (PI)

1995-1996 National Science Foundation: "Development of a variable flow seawater flume and high-speed video imaging system". (co-Investigator with J. Witman and T. Goslow).

1995 The Rhode Island Foundation: "Basic biomechanics of trabecular bone tissue: a novel small animal model". (PI) $152K

1992-1995 National Science Foundation: "The Biomechanics of Bat Flight: Skeletal architecture and functional performance". (PI) $190K

Service to the University (2009 - present):

Speaker, Science Center Science Café

Randall Advisor, Dean of the College Office, 2013 – present

Faculty Advising Fellows Program, Dean of the College Office, 2009- present

ADVANCE Program Junior Faculty Mentor, 2011 - present

Undergraduate Research and Teaching Assistantships Program Selection and Advisory Committee, 2005-present

Speaker, Sarah Doyle Women’s Center: A Conversation with Sharon Swartz, Professor in EEB and Engineering: Diversity and Women in the Academy

Selection Committee for Department of Education Master of Arts in Teaching Program in Biological Sciences, 2005-present

Advisory Board, Harriet W. Sheridan Center for Teaching and Learning, 2011 – present

Mentor, TEAM (Team Enhanced Advising and Mentoring) Program Mentor 2009-2012

Leader, TEAM (Team Enhanced Advising and Mentoring) Program Mentor 2012-2013

EPSCOR Graduate Fellowship Review Committee, 2011 – 2013

Review Committee, Life Sciences, Salomon and Seed Grants, Office of the Vice President of Research, 2013, 2011

Library Advisory Board, 2010 – 2012

EPSCOR Graduate Fellowship Review Committee, 2011 – 2013

Internal Advisory Board, Biomed Initiative to Maximize Student Development (IMSD), 2008 – 2011

Service to the Profession (2009-present only):

Chair, Division of Comparative Biomechanics, Society for Integrative and Comparative Biology, 2011 - 2013

Scientific Advisory Board, Lubee Bat Conservancy, Gainesville, Florida, 2008- present

Junior Faculty Mentoring Panel, American Society of Biomechanics, Fall 2010

Journal Editorships (Associate):

Journal of Morphology
Movement Ecology

Journals Refereed:

Acta Anatomica
Acta Chiropterologica
Bioinspiration and Biomimetics
Biological Journal of the Linnaean Society
Evolution and Development
Evolution
Experiments in Fluids
Journal of Anatomy
Journal of Biomechanics
Journal of Experimental Biology
Journal of Experimental Zoology
Journal of Mammalogy
Journal of Morphology
Journal of Zoology
Nature
Physics of Fluids
PLoS One
Proceedings of the Royal Society of London, Biological Sciences
Proceedings of the Royal Society of London, Interface
Science
Zoology

NSF Review Panelist, Processes, Structures and Integrity, IGERT, and FIBR Panels

NSF Ad hoc reviewer for Processes, Structures, and Integrity, IGERT, Biological Anthropology, Integrative Animal Biology, Ecological and Evolutionary Physiology Programs

Service to the Community, 2009-present:

Bat Wings: Beauty in Flight for NSF Exhibit at AAAS annual meeting, 2013

Featured research, Air Force Office of Scientific Research 60th Anniversary Video, 2012

Science consultant to The Compass School, a RI charter school devoted to environmental education

Brown Distinguished Speaker Summer @Brown series

Featured in Brown Alumni Monthly, "Dispatches from the Bat Cave"

Outreach on research to general public in diverse media, including interviews, video, text, and photos: New York Times, Natural History Magazine, The Loom (writer Carl Zimmer's blog), National

Geographic, Discovery Channel-Canada, the CBC, scienceblog.com, datadesk.com, Bat Conservation International website (batcon.org), defensetech.org, msnbc.msn.com, sciencenewforkids.org, physorg.com, newhavenscience.org, news.nationalgeographic.com, sciencecentral.com, newscientist.com, discovermagazine.com, forbes.com, news.softpedia.com, answers.yahoo.com, americanscientist.org

Research featured in BBC program *Invisible Worlds*

Sponsored and advised undergraduates working in educational outreach programs through the NASA/RI Space Grant Program

Participated in development and filming of "*Superbat*", documentary on the discovery of how bats fly and find their way in the dark by sonar by Gédeon Programmes, Paris. The program won the 2005 Gold Medal for Science Programming in the New York Film and Video Festival