CURRICULUM VITAE

Name: William McKee Kier

Reflective Statement:

I use a highly integrative approach because it provides the most powerful method of gaining novel insight into biological processes. My research is conducted at levels ranging from the behavior of the entire organism to the ultrastructure of its tissues, incorporating molecular and biochemical approaches, light and electron microscopy, whole cell patch clamp, muscle mechanics, mechanical testing, electromyography, and high-speed photography. I am interested in musculoskeletal systems, especially a type of hydrostatic skeleton that K.K. Smith and I have termed a "muscular hydrostat", common in soft, highly manipulative structures such as cephalopod mollusc appendages, vertebrate tongues and elephant trunks. I have collaborated with robotics engineers to design soft robotics that incorporate the principles of support and movement I discovered for these structures. I am also interested in the evolution of muscle specialization and have examined a fast-contracting muscle type that achieves high shortening velocity by structural rather than biochemical changes.

Education:

Duke University Marine Laboratory
Beaufort, NC
1976: Summer Terms

Colgate University
Hamilton, NY
1974-1978: B.A., Marine Science, 1978

Duke University
Durham, NC
1978-1983: Ph.D., Zoology, 1983

Professional Experience:

Professor Emeritus, Department of Biology, University of North Carolina, Chapel Hill, NC, 2023-present
Research Professor, Department of Biology, University of North Carolina, Chapel Hill, NC, 2022–2023.
Chair, Department of Biology, University of North Carolina, Chapel Hill, NC, 2008-2013.
Leadership Fellow, Institute for the Arts and Humanities' Academic Leadership Program, University of North Carolina at Chapel Hill, 2005-2006.
Associate Chair, Department of Biology, University of North Carolina, Chapel Hill, NC, 2002–2008.

Professor, Department of Biology, University of North Carolina, Chapel Hill, NC, 1999–2022.
Professor (joint), Curriculum in Marine Sciences, University of North Carolina, Chapel Hill, NC, 1999–2022.
Visiting Researcher, Hopkins Marine Station, Stanford University, Pacific Grove, CA, 2014, 2017, 2018
Visiting Researcher, Darling Marine Laboratory, University of Maine, Walpole, ME, 2011, 2012, 2013, 2019, 2021, 2022.
Visiting Researcher, Ine Marine Laboratory, Ine, Japan, 2001.
Associate Professor, Department of Biology, University of North Carolina, Chapel Hill, NC, 1991-1999.
Visiting Researcher, Marine Biological Laboratory, Woods Hole, MA, 1998, 1999, 2000.
Adjunct Associate Professor, Curriculum in Marine Sciences, University of North Carolina, Chapel Hill, NC, 1993-1999.
Assistant Professor, Department of Biology, University of North Carolina, Chapel Hill, NC, 1985-1991.
Visiting Researcher, Stazione Zoologica, Naples, Italy, 1985.
Visiting Researcher, The Laboratory, Marine Biological Association of the United Kingdom, Plymouth, England, 1984-1985, 1997, 1998.
Visiting Research Fellow, Department of Zoology, University of Sheffield, Sheffield, England, 1984-1985.
Postdoctoral Fellow, North Atlantic Treaty Organization Fellowships in Science, National Science Foundation, 1984-1985.
Postdoctoral Scholar, Department of Biology, Woods Hole Oceanographic Institution, Woods Hole, MA, 1983-1984.
COCOS Foundation Trainee, Department of Zoology, Duke University, Durham, NC, 1979-1983.

Marine Field Experience:
2019-2022 Cephalopod obliquely striated muscle research, Darling Marine Center, University of Maine, Walpole, ME. Collaborator: Joseph t. Thompson.
2017,2018 Cephalopod chromatophore research, Hopkins Marine Station, Stanford University, Pacific Grove, CA. Collaborator: William Gilly.
2014 Cephalopod muscle electrophysiology and membrane channel research, Hopkins Marine Station, Stanford University, Pacific Grove, CA. Collaborator: William Gilly.
2010-2012 Squid mantle muscle research, Darling Marine Center, University of Maine, Walpole, ME. Collaborator: Joseph T. Thompson.
2005 Biological transparency research, aboard *R.V. PELICAN*, Gulf of Mexico.
2001 Cephalopod muscle research, Ine Marine Laboratory, Ine, Japan.
1998-2000 Cephalopod muscle research, Marine Biological Laboratory, Woods Hole, MA.
1996, 1997 Cephalopod muscle research, The Laboratory, The Marine Biological Association of the U.K., Plymouth, England.
1987, 1994 Cephalopod muscle research, The Marine Biomedical Institute, University of Texas Medical Branch, Galveston, Texas.
1985 Cephalopod biomechanics research, Stazione Zoologica, Naples, Italy.
1984-1985 Cephalopod biomechanics research, The Laboratory, The Marine Biological Association of the U.K., Plymouth, England

1983, 1984 Oceanic squid research: aboard *R.V. COLUMBUS ISELINE*, Sargasso Sea.
1981 Squid research, Aquatron Laboratory, Institute of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada.
1980 Squid research, The Marine Biomedical Institute, University of Texas Medical Branch, Galveston, Texas.
1972-1979 Echinoid research, research assistant for Dr. P.M. Kier: Smithsonian Institution Investigations of Marine Shallow-Water Ecosystems, Carrie-Bow Cay, Belize; St. Croix, U.S.V.I.; Florida Keys.
1979 Damselfish aggressive behavior, research assistant for Dr. P. Klopfer: Smithsonian Institution Laboratory, Carrie-Bow Cay, Belize.
1978 Gastropod aperture research: aboard *M.S. LINDBLAD EXPLORER*, Sea of Cortez, Baja; St. Croix, U.S.V.I.
1977 Gastropod aperture research: aboard *M.S. LINDBLAD EXPLORER*, New Guinea, Solomon Islands, New Hebrides, Fiji.

Honors:

The Reinhard Rieger Award in Zoomorphology, 2015 (with Theodore A. Uyeno)
Bowman and Gordon Gray Professorship, University of North Carolina at Chapel Hill, 2003-2008.
Edward Kidder Graham Award, Favorite Faculty, Senior Class of 2004, University of North Carolina at Chapel Hill, 2004.
University of North Carolina at Chapel Hill Academy of Distinguished Teaching Scholars, inducted 2000.
Favorite Faculty Award, Superlative Contribution, Senior Class of 1997, University of North Carolina at Chapel Hill, 1997.
The Professor of the Year Award, State of North Carolina, Carnegie Foundation for the Advancement of Teaching and Council for Advancement and Support of Education, 1995.
The Board of Governors Award for Excellence in Teaching, University of North Carolina at Chapel Hill, 1995.
Tanner Award for Excellence in Teaching, University of North Carolina at Chapel Hill, 1993.
Presidential Young Investigator Award, National Science Foundation, 1987-1993.
Best Student Paper Award, (Hon. Men.), American Society of Zoologists Annual Meeting, 1982.
Best Student Paper Award, American Malacological Union Meetings, 1980.
Colgate University War Memorial Scholarship, 1974-1978.

Bibliography:

Chapters:

Kier, W.M. (1987) The functional morphology of the tentacle musculature of *Nautilus pompilius*. In *Nautilus: Biology and Paleobiology of the Living Fossil*, Saunders, W.B. and Landman, N.H. (Eds.). pp. 257-269. New York: Plenum. (refereed)

Kier, W.M. (1988) The arrangement and function of molluscan muscle. In *The Mollusca, Form and Function*, Trueman, E.R. and Clarke, M.R. (Eds.), Wilbur, K.M. (Ed.-in-Chief). **11**: 211-252. New York: Academic Press.

Kier, W.M. (1992) Hydrostatic skeletons and muscular hydrostats. In: *Biomechanics (Structures and Systems): A Practical Approach*. Biewener, A.A. (Ed.), IRL Press at Oxford University Press.

Refereed Papers:

McNair, C.G., Kier, W.M., LaCroix, P.D. and Linsley, R.M. (1981) The functional significance of aperture form in gastropods. *Lethaia* **14**: 63-70.

Kier, W.M. (1982) The functional morphology of the musculature of squid (Loliginidae) arms and tentacles. *Journal of Morphology* **172**: 179-192.

Linsley, R.M. and Kier, W.M. (1984) The Paragastropoda: A proposal for a new class of Paleozoic Mollusca. *Malacologia* **25**: 241-254.

Kier, W.M. and Smith, K.K. (1985) Tongues, tentacles and trunks: The biomechanics of movement in muscular-hydrostats. *Zoological Journal of the Linnean Society* **83**: 307-324.

Kier, W.M. (1985) The musculature of squid arms and tentacles: Ultrastructural evidence for functional differences. *Journal of Morphology* **185**: 223-239.

Kier, W.M., Messenger, J.B. and Miyan, J.A. (1985) Mechanoreceptors in the fins of the cuttlefish, *Sepia officinalis*. *Journal of Experimental Biology* **119**: 369-373.

Smith, K.K. and Kier, W.M. (1989) Trunks, tongues, and tentacles: Moving with skeletons of muscle. *American Scientist* **77**: 28-35.

Kier, W.M. (1989) The fin musculature of cuttlefish and squid (Mollusca, Cephalopoda): Morphology and mechanics. *Journal of Zoology (London)* **217**: 23-38.

Kier, W.M., Smith, K.K., and Miyan, J.A. (1989) Electromyography of the fin musculature of the cuttlefish, *Sepia officinalis*. *Journal of Experimental Biology* **143**: 17-31.

Kier, W.M. and Smith, A.M. (1990) The morphology and mechanics of octopus suckers. *Biological Bulletin* **178**: 126-136.

Westbrook, A.L., Haire, M.E., Kier, W.M., and Bollenbacher, W.E. (1991) Three-dimensional architecture of identified neurosecretory cells in an insect. *Journal of Morphology* **208**: 161-174.

Kier, W.M. (1991) Squid cross-striated muscle: the evolution of a specialized muscle fiber type. *Bulletin of Marine Science*. **49**: 389-403.

Kier, W.M. and Schachat, F.H. (1992) Biochemical comparison of fast- and slow-contracting squid muscle. *Journal of Experimental Biology* **168**: 41-56.

Smith, A.M., Kier, W.M., Johnsen, S. (1993) The effect of depth on the attachment force of limpets. *Biological Bulletin*. **184**: 338-341.

Johnsen, S. and Kier, W.M. (1993) Intramuscular crossed connective tissue fibres: skeletal support in the lateral fins of squid and cuttlefish. *Journal of Zoology*. **231**: 311-338.

McCurley, R.S. and Kier, W.M. (1995) The functional morphology of starfish tube feet: the role of a crossed-fiber helical array in movement. *Biological Bulletin*. **188**: 197-209.

Kier, W. M. (1996) Muscle development in squid: ultrastructural differentiation of a specialized muscle fiber type. *Journal of Morphology*. **229**: 271-288.

Kier, W.M. and van Leeuwen, J.L. (1997) A kinematic analysis of tentacle extension in the squid *Loligo pealei*. *Journal of Experimental Biology*. **200**: 41-53.

van Leeuwen, J.L. and Kier, W.M. (1997) Functional design of tentacles in squid: linking sarcomere ultrastructure to gross morphological dynamics. *Philosophical Transactions of the Royal Society of London, Series B* **352**: 551-571.

Thompson, J.T., Lowe, A.D. and Kier, W.M. (1998) The columellar muscle of prosobranch gastropods: morphological zonation and its functional implications. *Invertebrate Biology*. **117:** 45-56.

Van Leeuwen, J.L. and Kier, W.M. (1998) Dynamics and scaling of the tentacles in squid. *Biona Report* **13**: 9-10.

Johnsen, S. and Kier, W.M. (1998) Damage due to solar ultraviolet radiation in the brittlestar *Ophioderma brevispinum* (Echinodermata: Ophiuroidea). *Journal of the Marine Biological Association of the U.K.* **78:** 681-684.

Nishikawa, K., Smith, K.K. and Kier, W.M. (1999) Morphology and mechanics of tongue movement in the African pig-nosed frog *Hemisus marmoratum*: a muscular hydrostatic model. *The Journal of Experimental Biology* **202:** 771-780.

Johnsen, S. and Kier, W.M. (1999). Shade-seeking behavior under polarized light by the brittlestar *Ophioderma brevispinum*. *Journal of the Marine Biological Association of the United Kingdom* **79:** 761-763.

Van Leeuwen, J.L., de Groot, J.H., and Kier, W.M. (2000) Evolutionary mechanics of protrusible tentacles and tongues. *Netherlands Journal of Zoology*. **50:** 113-139.

Thompson, J.T. and Kier, W.M. (2001) Ontogenetic changes in mantle kinematics during escape jet locomotion in the Oval Squid, *Sepioteuthis lessoniana* Lesson, 1830. *Biological Bulletin* **201:** 154-166.

Thompson, J.T. and Kier, W.M. (2001) Ontogenetic changes in fibrous connective tissue organization in the Oval Squid, *Sepioteuthis lessoniana* Lesson, 1830. *Biological Bulletin* **201:** 136-153.

Kier, W.M. and Curtin, N.A. (2002) Fast muscle in squid (*Loligo pealei*): contractile properties of a specialized muscle fibre type. *Journal of Experimental Biology*. **205:** 1907-1916.

Thompson, J.T. and Kier, W.M. (2002) Ontogeny of squid mantle function: changes in the mechanics of escape jet locomotion in the Oval Squid, *Sepioteuthis lessoniana* Lesson, 1830. *Biological Bulletin*. **203:** 14-26.

Kier, W.M. and Smith, A.M. (2002) The structure and adhesive mechanism of octopus suckers. *Integrative and Comparative Biology*. **42:** 1146-1153.

Taylor, J.R.A. and Kier, W.M. (2003) Switching skeletons: hydrostatic support in molting crabs. *Science*. **301**: 209-210.

Kier, W.M. and Thompson, J.T. (2003) Muscle arrangement, function and specialization in recent coleoids. *Berliner Paläobiologische Abhandlungen*. **03**: 141-162.

Uyeno, T.A. and Kier, W.M. (2005) Functional morphology of the cephalopod buccal mass: a novel joint type. *Journal of Morphology*. **264**: 211-222.

Taylor, J.R.A. and Kier, W.M. (2006) A pneumo-hydrostatic skeleton in land crabs. *Nature*. **440**: 1005.

Thompson, J.T. and Kier, W.M. (2006) Ontogeny of mantle musculature and implications for jet locomotion in oval squid *Sepioteuthis lessoniana*. *Journal of Experimental Biology*. **209**: 433-443.

Uyeno, T.A. and Kier, W.M. (2007) Electromyography of the buccal musculature of octopus (*Octopus bimaculoides*): a test of the function of the muscle articulation in support and movement. *Journal of Experimental Biology* **210:** 118-128.

Kier, W.M. and Stella, M.P. (2007) The arrangement and function of octopus arm musculature and connective tissue. *Journal of Morphology*. **268**: 831-843.

Taylor, J.R.A. and Kier, W.M. (2007) Mechanical properties of the rigid and hydrostatic skeletons of molting blue crabs, *Callinectes sapidus* Rathbun. *Journal of Experimental Biology*. **210:** 4272-4278.

Kier, W.M. and Schachat, F.H. (2008) Muscle specialization in the squid motor system. *Journal of Experimental Biology*. **211**: 164-169.

Trivedi, D., Rahn, C.D., Kier, W.M., and Walker, I.D. (2008) Soft robotics: biological inspiration, state of the art, and future research. *Applied Bionics and Biomechanics*. **5**: 99-117.

Salisbury, S. M., Martin, G.G., Kier, W.M., and Schulz, J.R. (2010) Venom kinematics during prey capture in *Conus*: the biomechanics of a rapid injection system. *Journal of Experimental Biology*. **213**: 673-682.

Uyeno, T.A. and Kier, W.M. (2010) Morphology of the muscle articulation joint between the hooks of a flatworm (Kalyptorhynchia, *Cheliplana* sp.) *Biological Bulletin*. **218**: 169-180.

Shaffer, J.F. and Kier, W.M. (2012) Muscular tissues of the squid *Doryteuthis pealeii* express identical myosin heavy chain isoforms: an alternative mechanism for tuning contractile speed. *Journal of Experimental Biology*. **215**: 239-246.

Kier, W. M. (2012) The diversity of hydrostatic skeletons. *Journal of Experimental Biology*. **215**: 1247-1257.

Kurth, J.A. and Kier, W.M. (2014) Scaling of the hydrostatic skeleton of the earthworm, *Lumbricus terrestris*. *Journal of Experimental Biology*. 217: 1860-1867.

Thompson, J.T., Shelton, R.M, and Kier, W.M. (2014) The length-force behavior and operating length range of squid muscle vary as a function of position in the mantle wall. *Journal of Experimental Biology*. **217:** 2181-2192.

Kurth, J.A., Thompson, J.T. and Kier, W.M. (2014) Connective tissue in squid mantle is arranged to accommodate strain gradients. *Biological Bulletin*. **227:** 1-6.

Uyeno, T.A. and Kier, W.M. (2015) The structure and function of a muscle articulation-type jaw joint of a polychaete worm. *Journal of Morphology*. 276: 403-414.

Kurth, J.A. and Kier, W.M. (2015) Differences in scaling and morphology between lumbricid earthworm ecotypes. *Journal of Experimental Biology*. **218:** 2970-2978.

Shaffer, J.F. and Kier, W. M. (2016) Tuning of shortening speed in coleoid cephalopod muscle: no evidence for tissue-specific muscle myosin heavy chain isoforms. *Invertebrate Biology*. 135: 3-12.

Kier, W. M. (2016) The musculature of coleoid cephalopod arms and tentacles. *Frontiers in Cell and Developmental Biology*. 4.10. doi: 10.3389/fcell.2016.00010.

Taylor-Burt, K. R., Kier, W. M., Olszewski-Jubelirer, J. and Thompson, J. T. (2018) Shape, size and structure affect obliquely striated muscle function in squid. *Integrative and Comparative Biology*. **58**: 261-275.

Sholl, N., Moss, A., Kier, W. M., and Mohseni, K. (2019) A soft end effector inspired by cephalopod suckers and augmented by a dielectric elastomer actuator. *Soft Robotics*. https://doi.org/10.1089/soro.2018.0059

Gilly, W. F., Renken, C., Rosenthal, J. J. C., and Kier, W. M. (2020) Specialization for rapid excitation in fast squid tentacle muscle involves action potentials absent in slow arm muscle. *Journal of Experimental Biology*. **223**, jeb218081. doi:10.1242/jeb.218081.

Davis, A. L., Sutton, T. T., Kier, W. M., and Johnsen, S. (2020) Evidence that eye-facing photophores serve as a reference for counterillumination in an order of deep-sea fishes. *Proceedings of the Royal Society B: Biological Sciences*. 20192918. http://dx.doi.org/10.1098/rspb.2019.2918

Thompson, J.T., Taylor-Burt, K.R., and Kier, W.M. (2022) One size does not fit all: diversity of length-force properties of obliquely striated muscles. *Journal of Experimental Biology*. **226**, jeb244949. doi:10.1242/jeb.244949.

Van Leeuwen, J.L. and Kier, W.M. (2023) Predicting the effects of spatiotemporal modifications of muscle activation on the tentacle extension of squid. *Frontiers in Bioengineering and Biotechnology* 11:1193409. doi: 10:3389/fboe.2023.1193409.

Tekinalp, A., Naughton, N., Kim, S.-H., Halder, U., Gillette, R., Mehta, P.G., Kier, W.M. and Gazzola, M. (in review) Topology, dynamics, and control of a muscle-fiber architected soft arm. *Nature Machine Intelligence*.

Other:

Kier, W.M. (1996) Review of Maddock, L., Bone, Q., and Raynor, J. M. V., *Mechanics and Physiology of Animal Swimming*. New York: Cambridge University Press. *American Zoologist*. **36:** 385.

Walker, I.D., Dawson, D.M., Flash, T., Grasso, F.W., Hanlon, R.T., Hochner, B., Kier, W.M., Pagano, C.C., Rahn, C.D. and Zhang, Q.M. (2005) Continuum Robot Arms Inspired by Cephalopods. *Proceedings of SPIE*. **5804**: 303-314.

Kier, W. M. (2020) Muscle force is modulated by internal pressure. *Proceedings of the National Academy of Sciences*. **117**, 2245-2247. https://doi.org/10.1073/pnas.1921726117. (Invited Commentary).

Publications by Students in Laboratory of W.M. Kier:

Smith, A.M. (1991) Negative pressure generated by octopus suckers: a study of the tensile strength of water in nature. *Journal of Experimental Biology* **157**: 257-271.

Smith, A.M. (1991) The role of suction in the adhesion of limpets. *Journal of Experimental Biology* **161**: 151-169.

Smith, A.M. (1992) Alternation between attachment mechanisms by limpets in the field. *Journal of Experimental Marine Biology and Ecology* **160**: 205-220.

Johnsen, S. (1994) Extraocular sensitivity to polarized light in an echinoderm. *Journal of Experimental Biology*. **195**: 281-291.

Johnsen, S. (1997) Identification and localization of the visual pigment in the starfish *Asterias forbesi* (Asteroidea) and the brittlestar *Ophioderma brevispinum* (Ophiuroidea). *Biological Bulletin*. Marine Biological Laboratory, Woods Hole, **193**: 97-105.

Thompson, J.T. and Voight, J.R. (2003) Erectile tissue in an invertebrate animal: the *Octopus* copulatory organ. *Journal of Zoology*. **261**: 101-108.

Baines, A.T., McVey, M., Rybarczyk, B., Thompson, J.T., and Wilkins, H.R. (2004) The mystery of the toxic flea dip: an interactive approach to teaching aerobic cellular respiration. *Cell Biology Education*. **3**: 62-68.

Uyeno, T.A. and Hsiao (2007) A novel device to monitor small changes in underwater distances. *Invertebrate Biology*. **126**: 279-286.

Research Interests:

comparative biomechanics, in particular the functional morphology of musculoskeletal systems; muscle structure, function, development and evolution; invertebrate zoology, molluscs, in particular cephalopod biology

Teaching:

Courses taught recently:

Spring 2022, BIOL 451*, *Comparative Physiology*, 82 students
Spring 2022, BIOL 451L*, *Comparative Physiology Laboratory,* 40 students
Spring 2021, BIOL 451*, *Comparative Physiology*, 86 students
Spring 2021, BIOL 451L*, *Comparative Physiology Laboratory*, 41 students
Spring 2020, BIOL 451*, *Comparative Physiology*, 78 students
Spring 2020, BIOL 451L*, *Comparative Physiology Laboratory*, 36 students

Spring 2019, BIOL 451*, *Comparative Physiology*, 90 students
Spring 2019, BIOL 451L*, *Comparative Physiology Laboratory*, 35 students
Fall 2018, BIOL 858, *Seminar in Comparative Biomechanics*, 6 students
Fall 2018, BIOL 395, *Undergraduate Research*, 1 student
(*co-taught with T. Hedrick)

Courses taught in past:

Biology 252, *Human Anatomy and Physiology*
Biology 551, *Comparative Biomechanics*
Biology 890, *Philosophical and Practical Issues in Science*
Biology 890, *Teaching and Course Development*

Graduate Student and Postdoc Advisees:

Students:

Andrew M. Smith, *Adhesion and the Tensile Strength of Water in Nature*, Ph.D., 1992. Currently: Professor, Department of Biology, Ithaca College, NY.
Sönke Johnsen, *The Optical Design of the Photic System of Ophiuroids*, Ph.D., 1996. Currently: Professor, Department of Biology, Duke University, Durham, NC.
Joseph T. Thompson, *The Ontogeny of Mantle Structure and Function in the Oval Squid, Sepioteuthis lessoniana (Cephalopoda: Loliginidea)*, Ph.D., 2000. Currently: Professor, Department of Biology, Franklin and Marshall College, Lancaster, PA.
Diara D. Spain, *Peristaltic Locomotion in Holothuroids: Morphology and Movement*, Ph.D., 2002. Currently: Professor and Chair, Department of Natural Sciences and Mathematics, Dominican University of CA, San Rafael, CA.
Jennifer R.A. Taylor, *Hydrostatic Skeletons in the Crustacea: Support During Molting in an Aquatic and a Terrestrial Crab*, Ph.D., 2007. Currently: Associate Professor, Marine Biology Research Division, Scripps Institution of Oceanography, University of California, San Diego.
Theodore A. Uyeno, *The Morphology and Biomechanics of the Muscle Articulation: A New Class of Soft Tissue Joint*, Ph.D., 2007. Currently: Professor, Department of Biology, Valdosta State University, Valdosta, GA.
Jessica A. Kurth, *The Effects of Body Size on Soft-Bodied Burrowers*, Ph.D., 2015. Currently: Teva Pharmaceutical Industries, Ltd., Philadelphia, PA.
Julia M. Olszewski, *Obliquely Striated Muscle is Not Just for Super-Elongation,* M.S., 2015. Currently: Teacher at East Boston High School, East Boston, MA.

Postdocs:

Joseph T. Thompson, Professor, Department of Biology, Franklin and Marshall College, Lancaster, PA.
Rebecca M. Price, Professor, Interdisciplinary Arts and Sciences, University of Washington, Bothell.
Justin F. Shaffer, Teaching Professor, Colorado School of Mines, Golden, CO.

Grant Support

Obliquely Striated Muscle: A Soft-Bodied Invertebrate Solution for Tuning Length-Force Properties to Functional Demands, National Science Foundation, Physiological Mechanisms and Biomechanics Program, Division of Integrative Organismal Systems, J. Thompson, Franklin and Marshall University, Co-P.I., 9/1/18-8/31/23, ($273,318 to UNC).

Structural and Functional Connectivity of Squid Chromatophores, National Science Foundation, Physiological Mechanisms and Biomechanics, Division of Integrative Organismal Systems, W. F. Gilly, Stanford University, P.I., Subcontract to UNC-Chapel Hill, 7/1/16-6/30/21, ($91,051 to UNC).

Non-Uniform Distribution of Muscle Fiber Strain in Squid Mantle Muscle: Implications for Musculoskeletal System Structure, Function, and Evolution, National Science Foundation, Physiological and Structural Systems Cluster, Division of Integrated Organismal Systems, J. Thompson, Franklin and Marshall University, Co-P.I., 3/1/10-8/31/14, ($272,000 to UNC).

Transparency: Ultrastructural and Biochemical Specialization in Muscular and Ocular Tissues, National Science Foundation, Integrative Animal Biology Program, S. Johnsen, Duke University, Co-P.I., 3/1/05-2/29/08, ($189,999 to UNC).

Soft Robotic Manipulators and Manipulation, Defense Advanced Research Projects Agency, BAA Number BAA 01-42 (Addendum 11, Special Focus Area: Biodynotics), I. Walker, Clemson University, Co-P.I., W. M. Kier, UNC-CH, 9/1/03-8/17/06, ($340,342 to UNC)

Cephalopod Perception and Behavior Analysis for Mobile Robotics and Adaptive Manipulation, Defense Advanced Research Projects Agency, R. T. Hanlon, Marine Biological Laboratory, Woods Hole. Co P.I. W. M. Kier, UNC-CH, ($ 17,935 to UNC).

Manipulation and Contact Sensing via Trunks, Tentacles, and Whiskers. National Aeronautics and Space Administration, Research Opportunities in Biology-Inspired Technologies. P.I.: I. D. Walker, Clemson University. Co-P.I.s: W.M. Kier, UNC-CH & C.D. Rahn, Clemson University, 6/1/99-5/31/03, $381,992 ($74,594 to UNC)

Muscle Mechanics in Squid: An Integrated Analysis of Muscle Fiber Specialization. National Science Foundation, Integrative Animal Biology Program, 3/1/98 - 2/28/02, $243,000.

The Mechanics of Fast-Contracting Squid Muscle, NATO International Scientific Exchange Programmes, Collaborative Research Grant, CRG 971179, 10/1/97-9/30/99, BF127,000.

The Mechanics of a Specialized Muscle Fiber Type in Squid, UNC-CH University Research Council, 12/01/96-11/30/98,$2,187.

Polarization Sensitivity in Ophiuroids: The Structure and Ecological Function of a Diffuse Photic System, with S. Johnsen, National Science Foundation, Doctoral Dissertation Improvement Grant, IBN-9411834, 7/15/94-6/30/96, $8,246.

Muscle Development in Squid: An Integrative Analysis of Muscle Fiber Specialization, National Science Foundation, Functional and Physiological Ecology Program, IBN-9219495, 3/1/93-2/28/97, $298,000.

Development of Exercises for Biology 120, Comparative Physiology Laboratory, John T. Lupton Opportunities Fund, University of North Carolina, 12/11/92 - 6/30/93, $5,015.

Presidential Young Investigator Award, National Science Foundation, DCB 8658069, 8/15/87-1/31/93, $125,000 base grant, $500,000 with matching funds.

The Effect On Limpet Attachment Forces of Increase in Ambient Pressure Due to Depth (With Andrew M. Smith), National Oceanic and Atmospheric Administration National Undersea Research Center, 91-OT-KIER, 2/1/1991-12/31/1991, $1,080, use of hyperbaric facility.

Research Experiences for Undergraduates Supplement, National Science Foundation, supplement to DCB-8658069, 3/15/88-1/31/89, $2,276 & 5/15/91 - 8/15/91, $3,000

Junior Faculty Development Award, University of North Carolina at Chapel Hill, 1/1/87-12/31/87, $3,000.

The Development of Striation Types in Cephalopod Muscle, The UNC Chapel Hill University Research Council, 1/1/86-8/1/87, $550.

The Neurophysiology of Cephalopod Musculature, American Philosophical Society, 9/1/84-9/1/85, $895.

The Functional Morphology of the Arms and Tentacles of the Cuttlefish, The Lerner-Gray Fund for Marine Research of the American Museum of Natural History, 9/1/84-9/1/85, $910.

The Functional Morphology of Cephalopod Arms and Tentacles, Sigma-Xi Grants-in-Aid of Research, 4/1/82-4/1/83, $250.

Professional Service:

Department:
Diversity Initiatives Committee, 2018-2022.
Director of Undergraduate Studies, 2017-2018.
Director of Graduate Studies, EEOB, 2014.
EEOB Graduate Studies and Admissions Committee, 2013-2019
Chair's Advisory Committee, 2013-2018.

Grade Appeal Committee, Chair, 2007.
Biology Lecturer Search Committee, Chair, 2007.
Commencement Recognition Ceremony Committee, Chair, 2003-2006, member, 2007-2008.
Teaching Awards Committee, 2003-2008.
Integrative Organismal Biology Search Committee, Chair, 2004-2005.
Associate Chairman, Academic Affairs, 2002-2008.
Committee on Organismal Biology, Chair, 1998-2004.
Computer Committee, Chair, 1997-2002.
Liaison - Marine Sciences, 1986-1998; 2006-2008.
Chairman's Advisory and Planning Committee, 1992-2008.
Undergraduate Studies Committee, Chair, 1997-1998; member, 2002-2008.
Undergraduate Honors Program Committee, 1993-1996, Chair, 1995-1996.
Graduate Affairs Committee (recruitment, admissions, fellowships), 1989-1992.
Undergraduate Affairs Committee (curriculum, registration, advising), 1986-1997.
Seminar Program Committee, 1988-1992.
Microscopy Facility Committee, 1986-2002, Chairman, 1991-2002.
Integrative Organismal Physiology Search Committee, 2002-2003.
Evolutionary Biology Search Committee, 2000-2001.
Animal Behavior and Ecology Search Committee, 1995-1996.
Integrative Organismal Biology Search Committee, Chair, 1994-1995.
Evolutionary Biology Search Committee, 1992-1993.
Ecology Search Committee, 1991-1992.
Invertebrate Biology Search Committee, 1989-1990.
Evolutionary Biology Search Committee, 1988-1989.
Plant Systematics Search Committee, 1986-1987.
Faculty Secretary, 1986-1987.

University:
Curriculum 2019 Ideas, Information, and Inquiry Feasibility and Design Committee, UNC-CH, 2017-2018
Curriculum 2019 Discipline Area Task Force, UNC-CH, 2017
Graduate Education Working Group, The Graduate School, UNC-CH, 2017
Search Committee, Director, North Carolina Botanical Garden, 2014-2015.
Academic Support Program for Student Athletes Advisory Committee, 2013-2016.
Search Committee, Executive Vice Chancellor and Provost, UNC-CH, 2013.
Chair, Council of Chairs, College of Arts and Sciences, UNC-CH, 2012-2013.
Department of Psychology External Review, Committee Member, 2010.
Dean’s Advisory Committee, College of Arts and Sciences, UNC-CH, 2009-2013.
Search Committee, Dean of College of Arts and Sciences, UNC-CH, 2008-2009.
Executive Committee, Curriculum in Applied Science and Engineering, 2008-2010.
Faculty Sponsor, UNC-CH Unite for Sight, 2004-2008.
Bowman and Gordon Gray Professorship Selection Committee, 2004.
Teaching Assistant Advisory Task Force, 2002-2003.
Search Committee, Senior Associate Dean for Undergraduate Education, 2001.
Search Committee, Assistant University Librarian for Collections and Resource Services, 2001.
Steering Committee, UNC-CH Academy of Distinguished Teaching Scholars, 2000.
Advisory Committee for Prestigious Scholarships, 1998-2004.

Barry M. Goldwater Scholarship Committee, 1999-2008; Chair, 2002-2003, 2004-2008.
Dean's Faculty Consultative Committee, 1999-2002.
Administrative Board of the Graduate School, 1999–2002.
Search Committee, Full-time Advisor Initiative, General College and Arts and Sciences, 1999.
Administrative Board of the Library, Natural Sciences, 1998-2001.
Advisory Board, UNC-CH Study Abroad Program, 1997-2000.
Honors Program Faculty Advisory Board, 1996-1999.
Endowment Committee of the College of Arts and Sciences, 1996-1999.
University Committee on Teaching Awards, Chairman of Tanner Award Subcommittee, 1995-1996.
Scholarly Publications, Artistic Exhibitions, and Performances Committee, 1994-1997.
Advisory Committee of Applied Sciences Curriculum, 1992-1995.
Presentation for North Carolina Renaissance Program, UNC-CH, 5/9/96
Howard Hughes Program for Minority Advancement in the Biomolecular Sciences - *Frontiers in Marine Biology* Course Leader, 6/1991, 6/1992, 6/1993, 6/1994.
Faculty and Biology Department Representative, Carolina Contact: Carolina Fair Days Program, 1988, 1990, 1992, 1993.
Faculty and Biology Department Representative, Carolina Close-up, 1998.
Faculty Council, Natural Sciences, Alternate, 1990- 991.
Guest faculty, Marine Carbonate Environments, MASC 223, C. Neumann, San Salvador, Bahamas, March, 1989.
Faculty Sponsor, UNC Outing Club, 1989 -1993.

National:
Nominating Committee, Division of Comparative Biomechanics, Society for Integrative and Comparative Biology, 2019.
External Review Team Member, Department of Biology, Case Western Reserve University, Cleveland, OH, October, 2018.
Nominating Committee, Society for Integrative and Comparative Biology, 2015-2016.
Graduate Program Review Team Member, Biology and Marine Biology Graduate Program, University of North Carolina at Wilmington, April, 2015.
Associate Editor, *Biological Bulletin,* 2010-present
Senior Advisory Board, *Journal of Morphology*, 2008-present
Associate Editor, *Journal of Morphology,* 1997-2008
Advisory Council, *Acta Zoologica*, 2004-present
Panelist, Wake Forest University Graduate School of Arts and Sciences 2008 Forum, *Interdisciplinary Research: Expanding Research Impact and Opportunity*
International Advisory Board, Conferences Internationales Materiaux et Technologies, Smart Materials, Structures, and Systems, 2008, *Mining Smartness from Nature, From Bio-Inspired Materials to Bionic Systems*
Panel Member, Certificate in Teaching College Biology Program, Department of Biology, Duke University, Spring 2004.
Member-at-Large, Executive Committee, Society for Integrative and Comparative Biology, 2002-2005
Co-Organizer (with R. T. Hanlon and F. Grasso) of meeting for United States Defense Advanced Research Projects Agency entitled "Cephalopod Arms, Tentacles and Senses as Inspiration for Novel Robotic Manipulators", May 3-6, 2001, J. Erik

Jonsson Woods Hole Center of the National Academy of Sciences, Woods Hole, MA.

Panel Member, National Science Foundation, Integrative Animal Biology Panel, 2000, 2001

Council Delegate, Section of Biological Sciences, American Association for the Advancement of Science, 1998-2001.

Member-at-Large, Executive Committee, American Microscopical Society, 2000-2006

Speaker, "Undergraduate Teaching", University of North Carolina at Chapel Hill Board of Visitors, Chapel Hill, NC, 11/11/95.

External Examiner, Ph.D. dissertation of J. A. Hoar, Department of Biology, Dalhousie University, Halifax, NS, Canada, 8/18/95.

Keynote Speaker, Excellence in Education Awards Banquet, Alamance County Area Chamber of Commerce, Burlington, NC, 5/23/95.

Panelist, "Educating for Science: Meeting the Challenges", Dedication of Leon Levine Science Research Center, Duke University, 12/10/94.

Participant, Career Exploration Program, Chapel Hill High School, 1994.

Participant, Career Shadowing Program, Stanford Middle School, 1994.

Mentor, North Carolina School of Science and Math Mentorship Program, 1989-1990, 1992-1993.

Advisory Panel, North Carolina Museum of Life and Science Exhibit, *Life in a Physical World*, 1991-1993.

American Malacological Union, Councillor-at-large, 1991-1994.

Panel Member, Sigma-Xi Grants-in-Aid of Research, 1987-1995.

Chairman, Best Student Paper Award Committee, American Malacological Union Meetings, 1990.

Referee, Best Student Paper Award Committee, Invertebrate Zoology Division, American Society of Zoologists Annual Meetings, 1987, 1988, 1989, 2000.

Member, Constitution and Bylaws Committee, Membership Committee, American Malacological Union, 1990-1994.

Lecturer/ Guest Faculty, Organization for Tropical Studies, Course 86-1, Tropical Biology: An Ecological Approach, Monteverde, Costa Rica, C.A., January-February, 1986.

Reviewer:

Acta Physica Polonica
Acta Zoologica
American Malacological Bulletin
Arthropod Structure and Development
Bioinspiration and Biomimetics
Biological Bulletin
Biological Cybernetics
Biological Journal of the Linnean Society
Biology Letters
Biotechnic and Histochemistry
Biotechnology Advances
Bulletin of Marine Science
Comparative Biochemistry and Physiology
Composites Science and Technology
Computers in Biology and Medicine
Current Biology

Frontiers in Physiology
Frontiers in Zoology
Integrative and Comparative Biology
Invertebrate Biology
Journal of Anatomy
Journal of Applied Physiology
Journal of Comparative Physiology A
Journal of the Elisha Mitchell Society
Journal of Experimental Biology
Journal of the Marine Biological Association of the UK
Journal of Molluscan Studies
Journal of Morphology
Journal of Nuclear Medicine
Journal of the Royal Society Interface
Journal of Theoretical Biology
Journal of Zoology
Latin American Journal of Aquatic Research
Lethaia
Malacologia
Marine Biology
Paleobiology
Physiology
Proceedings of the Royal Society
Proceeding of the National Academy of Sciences
Royal Society Letters
Royal Society Open Science
Science
Veliger
Vie et Milieu
Zoological Journal of the Linnean Society
Zoology
Zoomorphology

Reviewer of proposals to:
Army Research Office
Biotechnology and Biological Sciences Research Council, UK
Human Frontier Science Program
Israel Science Foundation
Jeffress Trust
National Science Foundation
National Undersea Research Center
North Carolina Biotechnology Center

Professional Societies:

American Association for the Advancement of Science
American Malacological Society
American Microscopical Society

Marine Biological Association of the United Kingdom
Sigma Xi
Society for Experimental Biology
Society for Integrative and Comparative Biology

Invited Lectures:

Museum of Comparative Zoology, Harvard University, 5/27/82
"Functional Morphology of Squid Arms and Tentacles"

Colgate University, Hamilton, NY 11/13/82
"The Attack of the Squid"

Department of Zoology, Duke University, 2/28/83
"The Biomechanics of Movement in Squid Arms and Tentacles"

Department of Invertebrate Zoology, Smithsonian Institution, Washington, D.C. 6/22/83
"The Functional Morphology of Squid Arms and Tentacles"

Capitol Shell Club, Washington, D.C., 1/26/84
"The Strike of the Squid"

Marine Science and Maritime Studies Center, Northeastern University, 2/17/84
"The Strike of the Squid: Biomechanics of Movement in Squid Arms and Tentacles"

Department of Biology, Woods Hole Oceanographic Institution, 2/23/84
"The Strike of the Squid: Biomechanics of Movement in Squid Arms and Tentacles"

The Marine Biological Association of the United Kingdom, Plymouth, England, 1/15/84
"The Strike of the Squid: The Biomechanics of Movement in Squid Arms and Tentacles"

Department of Biology, University of North Carolina at Chapel Hill, 2/5/85.
"The Strike of the Squid: The Functional Morphology of the Arms and Tentacles"

Department of Zoology, University of Manchester, England, 2/27/85
"Squid Arms and Tentacles: Biomechanics of Muscular Hydrostats"

Duke University Marine Laboratory, Beaufort, NC, 10/22/86
"Tongues, Tentacles and Trunks: The Biomechanics of Movement in Muscular-Hydrostats"

Department of Zoology, University of Florida, Gainesville, FL,11/18/86
"The Strike of The Squid"

Department of Neurology, School of Medicine, University of North Carolina at Chapel Hill, Neuromuscular Symposium 8/11/87
"The Musculature of Squid Arms and Tentacles: Ultrastructural Evidence for Functional Differences"

Marine Sciences Curriculum, University of North Carolina at Chapel Hill, 2/24/88
"The Strike of the Squid: The Biomechanics of the Arms and Tentacles"

Institute of Marine Sciences, Morehead City, NC, 5/13/88
"The Functional Morphology of the Musculature of Squid Arms and Tentacles"

Department of Biology, University of Pennsylvania, 3/17/88
"The Strike of the Squid: The Biomechanics of the Arms and Tentacles"

Duke University Marine Laboratory, 8/9/88
Guest lecture for Invertebrate Zoology, Zool 274L, (E.E. Ruppert & R.S. Fox, instructors), "Morphology and Mechanics of Cephalopods"

Department of Biology, Wake Forest University, 11/2/88
"The Strike of the Squid: The Biomechanics of Cephalopod Arms and Tentacles"

Department of Organismal Biology and Anatomy, The University of Chicago, 5/9/89
Guest lecture for Biological Oceanography, Biosci 278, (B. Block, instructor), "Hydrostatic Skeletons in the Sea"

Department of Organismal Biology and Anatomy, The University of Chicago, 5/10/89
"Tongues, Tentacles and Trunks: The Biomechanics of Movement in Muscular-Hydrostats"

Department of Biological Anthropology and Anatomy, Duke University Medical Center, 10/3/90
"Squid Muscle: A Case Study of Functional Specialization"

Department of Biology, University of North Carolina, Chapel Hill, 10/16/90
"Squid Cross-Striated Muscle: A Case Study of the Evolution af a Specialized Muscle Fiber Type"

North Carolina Shell Club, Morehead City, NC, 11/17/90, annual banquet address
"Squid, Nautilus and Octopi: Moving With Skeletons of Muscle"

Department of Physiology and Biophysics, University of Illinois, Urbana, 11/30/90
"Squid Cross-Striated Muscle: A Case Study of the Evolution af a Specialized Muscle Fiber Type"

Department of Neurobiology and Anatomy, Bowman Gray School of Medicine, Wake Forest University, 2/20/91

"Squid Cross-Striated Muscle: A Case Study of the Evolution af a Specialized Muscle Fiber Type"

Department of Kinesiology, University of California, Los Angeles, 2/28/91
"Squid Cross-Striated Muscle: A Case Study of the Evolution af a Specialized Muscle Fiber Type"

Department of Zoology, Arizona State University, Tempe, AZ, 9/24/91
"The strike of the squid: Biomechanics of Cephalopod Arms and Tentacles"

Office of Naval Research Workshop on Novel Robotic Actuators, Arlington, VA, 11/3/91
"Mechanics and Control of Non-Skeletal Muscular Structures such as Trunks and Tentacles"

Department of Zoology, Duke University, Durham, NC, Duke-UNC Biomechanics Group, 3/10/92
"The Functional Morphology of the Water Vascular System of Echinoderms"

Department of Geology, Colgate University, Hamilton, NY, 4/11/92
"Tentacles, Tongues and Tulip Shells"

Department of Biology, The University of North Carolina at Greensboro, Greensboro, NC, 9/16/92
"Squid Cross-Striated Muscle: Evolution of a Specialized Fiber Type"

Department of Zoology, Duke University, Durham, NC, 10/12/92
"Squid Cross-Striated Muscle: Evolution of a Specialized Fiber Type"

Institute of Marine Sciences, Morehead City, NC, 9/29/94
"Tongues, Tentacles and Trunks: An Integrative Analysis of Muscular-Hydrostats"

Department of Biology, Florida State University, Talahassee, FL, 10/20/94
"Tongues, Tentacle and Elephant Trunks: Moving with Skeletons of Muscle"

Department of Biology, Florida State University, Talahassee, FL, 10/21/94
"An Integrative Analysis of Muscle Fiber Specialization in Squid"

Department of Biology, East Carolina University, Greenville, NC, 3/23/95
"An Integrative Analysis of Muscle Fiber Specialization in Squid"

Hopkins Marine Station of Stanford University, Pacific Grove, CA, 5/11/95
"Integrative Analysis of Muscle Fiber Specialization in Squid"

College Lights Presentation, College of Arts and Sciences, the General Alumni Association and the Arts and Sciences Foundation, UNCCH, Chapel Hill, NC 11/7/95.

"Similarities Between Tongues, Tentacles and Elephant Trunks: Why Your Tongue is an Octopus Arm"

Joint UNCCH-Duke Biomechanics Group Meeting, 1/30/96.
"Muscle Development in Squid: An Integrated Analysis of Muscle Specialization and Evolution"

Duke University Marine Laboratory, Beaufort, NC 4/10/96.
"The Strike of the Squid: Mechanisms of Muscle Specialization"

Dental Research Center, University of North Carolina, Chapel Hill, NC 4/17/96.
"Integrative Analysis of Muscle Fiber Specialization in Squid"

James Cook University, Townsville, Australia, 8/8/96.
"The Strike of the Squid: Mechanisms of Muscle Specialization"

Monash University, Melbourne, Australia, 8/15/96.
"The Strike of the Squid: Mechanisms of Muscle Specialization"

Joint UNCCH-Duke Biomechanics Group Meeting, 10/15/96.
"Mechanical Design in Squid Tentacles: Linking Sarcomere Ultrastructure to Gross Morphological Dynamics."

Appalachian State University, Boone, NC, 10/30/96.
"The Strike of the Squid: Mechanisms of Muscle Specialization"

Duke University Department of Zoology, Biology Undergraduate Seminars, 4/8/97.
"The Strike of the Squid: Mechanisms of Muscle Specialization"

Distinguished Seminar Series, Graduate Program in Organismic and Evolutionary Biology, University of Massachusetts, Amherst, USA, 4/2/98.
"The Strike of the Squid: Mechanisms of Muscle Specialization"

Joint UNCCH-Duke Biomechanics Group Meeting, 4/14/98.
"Muscle Mechanics in Squid: An Integrated Analysis of Muscle Specialization"

Joint UNCCH-Duke Biomechanics Group Meeting, 11/19/98.
"Mechanisms of Muscle Specialization: The Mechanics of Fast and Slow Squid Muscle"

Evolutionary Morphology Seminar Series, University of Chicago, Chicago, IL, USA, 2/4/99.
"Fast and Slow Squid Muscle: The Evolution of Muscle Fiber Specialization"

Virginia Institute of Marine Sciences, Gloucester Point, VA, USA, 11/9/99.
"Fast and Slow Squid Muscle: An Integrative Analysis of Fiber Specialization"

Perspectives in Biology Symposium, Featured Speaker, Wake Forest University, Winston-Salem, NC, 11/12/99-11/13/99.

"Tentacles, Tongues and Elephant Trunks: Moving with Skeletons of Muscle."
"Fast and Slow Squid Muscle: An Integrative Analysis of Fiber Specialization"

Joint UNCCH-Duke Biomechanics Group Meeting, 11/18/99.
"Ontogeny of Muscle and Prey Capture Behavior in Squid"

University of Rhode Island, Kingston, RI, 8/25/00.
"Fast Squid Muscle: An Integrative Analysis of Fiber Specialization"

Woods Hole Oceanographic Institution, Woods Hole, MA, 12/14/00.
"Fast Squid Muscle: An Integrative Analysis of Fiber Specialization"

Center for Biologically Inspired Materials and Material Systems, Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC, 1/24/01.
"Tentacles, Tongues and Other Muscular Hydrostats: Inspiration for Robotic Manipulators?"

Keynote Speaker, Howard Hughes Biology Forum, Department of Biology, Duke University, Durham, NC, 4/12/01.
"The Strike of the Squid: An Integrative Analysis of Muscle Specialization"

Joint UNCCH-Duke Biomechanics Group Meeting, 4/17/01.
"The Mechanics of Fast-Contracting Squid Muscle"

The Defense Advanced Research Projects Agency, Arlington, VA, 7/11/01.
"Morphology and Biomechanics of Muscular Hydrostats"

Integrative Graduate Education and Research Training Program in Neuro-Mechanical Systems, Case Western Reserve University, Cleveland, OH, 11/5/01.
"The Strike of the Squid: An Integrative Analysis of Muscle Fiber Specialization"

The Defense Advanced Research Projects Agency, Arlington, VA, 11/29/01
"Structure and Mechanics of Muscular Hydrostats"

Joint UNCCH-Duke Biomechanics Group Meeting, 2/12/02
"The Structure and Adhesive Mechanism of Octopus Suckers"

Defense Advanced Research Projects Agency / Defense Sciences Research Council Planning Meeting on Dynamically Stable, Malleable, Materials and Structures, Arlington, VA, 10/9/02
"Morphology and Biomechanics of Muscular-Hydrostats"

The Department of Biology, Duke University, Durham, NC, 10/20/02
"The Strike of the Squid: An Integrative Analysis of Muscle Fiber Specialization"

Defense Advanced Research Projects Agency / Defense Sciences Research Council Workshop on Dynamically Stable, Malleable, Materials and Structures, Arlington, VA, 2/4/03.
"Morphology and Biomechanics of Muscular-Hydrostats"

Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, Raleigh, NC 11/10/03.
"Tongues, Elephant Trunks, Squid Tentacles, and Soft Robots"

Department of Biology, University of Virginia, Charlottesville, VA 4/23/04.
"The Strike of the Squid: An Integrative Analysis of Muscle Fiber Specialization"

Elizabeth City State University, Elizabeth City, NC, 3/21/06.
"Squid Tentacles, Elephant Trunks, Tongues, and Soft Robots"

Osher Lifelong Learning Institute, Durham, NC. Scientific Excursions and Diversions Program, 3/6/07
"Squid Tentacles, Elephant Trunks, Tongues, and Soft Robots"

Pembroke University, Pembroke, NC. Plenary Speaker, Pembroke University Research and Creativity Forum, 4/16/07.
"Soft Robots"

Wake Forest University, Winston-Salem, NC, 10/15/07.
"Continuum Robot Arms Inspired by Cephalopods"

College of Charleston, Grice Marine Laboratory, George D. Grice, Jr. Memorial Lecture, 11/9/07.
"Fast and Slow Squid Muscle: An Integrative Analysis of Fiber Evolution and Specialization"

University of Chicago, Chicago, IL, 11/6/08.
"Fast and Slow Squid Muscle: An Integrative Analysis of Fiber Evolution and Specialization"

Wake Forest University, Winston-Salem, NC, 9/22/09.
"Tentacles that Twist, Tense, Telescope and Torque: Biological Inspiration for Flexible Robots."

Brown University, Providence, RI, 9/30/11.
"Fast and Slow Squid Muscle: An Integrative Analysis of Fiber Evolution and Specialization"

Darling Marine Center, University of Maine, Walpole, ME, 07/27/12.
"Fast and Slow Squid Muscle: An Integrative Analysis of Fiber Evolution and Specialization"

Duke University, department of Biology, Durham, NC, 04/17/14.

The Schmidt-Nielsen Memorial Lecture
"How Squid Build Fast Muscle"

Western Carolina University, Cullowhee, NC, 04/10/15.
The Paul Burton Seminar Series
"How Squid Build Fast Muscle: An Integrative Analysis of Fiber Evolution and Specialization"

Raleigh Charter High School, Raleigh, NC, 04/23/15.
Tech Talk Series
"Squid Tentacles, Elephant Trunks, Tongues and Soft Robots"

UNC Chapel Hill Program in Humanities, Spotlight on Scholars, 09/29/15.
"Squid Tentacles, Elephant Trunks, Tongues and Soft Robots"

University of Florida College of Engineering, Department of Mechanical and Aerospace Engineering, Gainesville, FL 10/29/15.
"How Squid Build Fast Muscle: An Integrative Analysis of Fiber Evolution and Specialization"

North Carolina Museum of Life and Science, Durham, NC, 11/12/15.
Museum After Hours Series
"Robot Arms Inspired by Tongues, Tentacles and Elephant Trunks"

Croasdaile Village Lecture Series, Durham, NC, 11/15/16.
"Squid Tentacles, Tongues, Elephant Trunks and Soft Robots"

Brown University, Ecology and Evolutionary Biology Seminar Series, Graduate Student Invited Speaker, Providence, RI, 3/20/18
"The Diversity of Hydrostatic Skeletons"

Center for Micro-BioRobotics, Insituto Italiano di Technologia, Pisa, Italy, 3/11/19.
"The Diversity of Hydrostatic Skeletons"

Pilgram Marpeck School of Science, Technology, Engineering, and Mathematics, Truett McConnel University, Cleveland, GA, 3/25/21
"*How Squid Build Fast Muscle: An Integrative Analysis of Fiber Evolution and Specialization*"

Franklin and Marshall College, Lancaster, PA, 1/31/23.
"The Diversity of Hydrostatic Skeletons"

Meetings, Invited Symposia Talks, Presentations, and Published Abstracts:

American Malacological Union Meetings, Louisville, Kentucky, 1980: "Functional Morphology of Squid Arms and Tentacles", talk.

American Malacological Union Meetings, Fort Lauderdale, Florida, 1981:
"The Paragastropoda: A Proposal for a New Class of Paleozoic Mollusca", (co-authored with R. M. Linsley), talk presented by Linsley.
"Workshop on Underwater Photography", talk.

American Society of Biomechanics, Seattle, Washington, 1982: "The Biomechanics of Movement in Tongues and Tentacles", (co-authored with K.K. Smith), talk.

American Society of Zoologists, Louisville, Kentucky, 1982: "Squid Appendage Biomechanics: Functional Difference Between Arms and Tentacles is Reflected in Ultrastructural Difference", talk, Abstract: *American Zoologist* 22: 967.

American Society of Zoologists, Philadelphia, Pennsylvania, 1983: "Tongues, Tentacles and Trunks: The Biomechanics of Movement in Muscular-Hydrostats", (co-authored with K.K. Smith), talk, Abstract: *American Zoologist* 23: 904.

Society for Experimental Biology, Leeds, England, 1985: "Squid Arms and Tentacles: Biomechanics of Movement in Muscular-Hydrostats", talk.

American Association for the Advancement of Science, Nautilus Workshop, Bryn Mawr, Pennsylvania, 1986: "Functional Morphology of Tentacle Musculature", talk.

American Society of Zoologists, New Orleans, Louisiana, 1987: "The Fin Musculature of Cuttlefish and Squid: Morphology and Mechanics", talk, Abstract: *American Zoologist* 27: 150A.

American Society of Zoologists, San Francisco, California, 1988: "Electromyography of the Fin Musculature of the Cuttlefish", (authored with K.K. Smith & J.A. Miyan), talk, Abstract: *American Zoologist* 28: 142A.

Symposium International Sur La Seiche, Université de Caen, Caen, France, 1989: "The Fins of Sepia: A Test of the Muscular-Hydrostat Model", (authored with K.K. Smith, J.A. Miyan), poster.

American Society of Zoologists, Boston, Massachusetts, 1989: "Biochemical Comparison of Fast- and Slow-Contracting Squid Muscle", poster, Abstract: *American Zoologist* 29: 158A.

"The Functional Morphology of Octopus Suckers: Implications for Sucker Function in General", (co-authored with A.M. Smith), talk presented by A. M. Smith, Abstract: *American Zoologist* 29: 30A.

American Malacological Union Annual Meeting, Woods Hole, Massachusetts, 1990: "Squid Cross-Striated Muscle: A Case Study of the Evolution of a Specialized Muscle Fiber Type", (co-authored with F.H. Schachat), talk.

American Society of Zoologists Annual Meeting, Atlanta, GA, 1991: "Squid Cross-Striated Muscle: The Evolution of a Specialized Fiber Type", talk, Abstract: *American Zoologist* 31: 728A.
"Crossed Connective Tissue Fibers: Skeletal Support in Squid and Cuttlefish Fins", (co-authored with S. Johnsen), talk presented by S. Johnsen, Abstract: *American Zoologist* 31: 317A.

American Malacological Union Annual Meeting, aboard *Nordic Empress*, the Bahamas, 1993: "Crossed Connective Tissue Fibers: A Novel Support System in Squid and Cuttlefish", talk.

American Society of Zoologists Annual Meeting, Los Angeles, CA, 1993: "The Functional Morphology of Starfish Tube Feet: The Role of a Crossed-Fiber Array in Movement", talk, Abstract: *American Zoologist* 33: 115A.

Cephalopod International Advisory Council Meetings, The Behaviour and Natural History of Cephalopods, Vico Equense, Italy, 1994: "The Tentacle Musculature of Juvenile Squid: Morphological Constraints on Behaviour", talk.

American Society of Zoologists Annual Meeting, St. Louis, MO, Jan. 1995: "Muscle Development in Squid: Morphological Constraints on Behavior", talk, Abstract: *American Zoologist* 34: 128A.

International Union of Biological Sciences, 4th International Congress of Comparative Physiology and Biochemistry, Birmingham, U.K., August, 1995, Invited talk in *Hydraulics and Hydrostats* Symposium: "Tentacles, Tongues and Trunks: the functional morphology of muscular hydrostats", Abstract: *Physiological Zoology* 68(4): 40.

Twelfth International Malacological Congress, Vigo, Spain, September, 1995, Invited talk in *Functional Morphology of Cephalopods* Symposium: "Muscle Development in Squid: An Integrated Analysis of Muscle Specialization and Evolution", Abstract*: Unitas Malacologica, Abst. 12th Intern. Malacol. Congr., Vigo, 1995*, A. Guerra, E Rolán and F. Rocha, eds.

Society for Integrative and Comparative Biology Annual Meeting, Washington, D.C., Dec. 1995: "The Functional Morphology of the Columellar Muscle of Gastropods: Morphological Zonation and its Implications". (co-authored with J. Thompson) Abstract: *American Zoologist* 35: 52A.

"The Mechanism of Tongue Elongation During Feeding in *Hemisus marmoratum*. (co-authored with K.K. Smith and K.C. Nishikawa) Abstract: *American Zoologist* 35: 102A.

Society for Experimental Biology Annual Meeting, Lancaster, England, March 1996: "A Kinematic Study of the Tentacle Extension in the Squid *Loligo pealei*." (co-authored with J.L. van Leeuwen).

"A Dynamic Multi-Compartment Model of the Tentacle Strike in Squid." (co-authored with J.L van Leeuwen).

Society for Integrative and Comparative Biology Annual Meeting, Albuquerque, NM, December 1996: The Tentacular Strike of Squid: Mechanical Design of a Muscle System at Multiple Levels of Organization." (co-authored with J.L. van Leeuwen). Abstract: *American Zoologist* 36: 9A.

International Conference on Motion Systems, Jena, 1997: "Dynamics and Scaling of the Tentacles of Squid." (co-authored with J.L. van Leeuwen). Abstract: *International Conference on Motion Systems Program and Abstracts* pp. 90-91.

Netherlands Anatomical Society, January, 1999: "Evolutionary Mechanics of Muscular Systems." (co-authored with J.L. van Leeuwen, J.H. de Groot, K.C. Nishikawa, & C.W. Spoor). Abstract: *European Journal of Morphology*. 37: 269.

Society for Integrative and Comparative Biology Annual Meeting, Atlanta, GA, January 2000: "Mechanics of Fast-Contracting Squid Muscle: Mechanisms of Specialization." (co-authored with N.A. Curtin). Abstract: *American Zoologist* 39: 117A.

Society for Experimental Biology Annual Meeting, Exeter, UK, March 2000. "Fast squid muscle: an integrative analysis of fibre specialization." (co-authored with N. A. Curtin). Abstract: *Experimental Biology Online* 5: 35. (HTTP://LINK.SPRINGER.DE/LINK/SERVICE/JOURNALS/00898/TOCS.HTM)

Cephalopod Arms, Tentacles and Senses as Inspiration for Novel Robotic Manipulators, Sponsored by the United States Defense Advanced Research Projects Agency, J. Erik Jonsson Woods Hole Center of the National Academy of Sciences, Woods Hole, MA, May 2001.
"Introduction to the Morphology and Biomechanics of Muscular-Hydrostats"
"Morphology and Mechanics of Cephalopod Arms and Tentacles"
(abstracts published in meeting program)

Society for Integrative and Comparative Biology Annual Meeting, Anaheim, CA, January 2002: "The Structure and Adhesive Mechanism of Octopus Suckers". (co-authored with A.M. Smith) Invited talk to *Biomechanics of Adhesion* Symposium. Abstract: *American Zoologist* **41:** 1492.

International Symposium on Coleoid Cephalopods Through Time, Berlin, Germany, September 2002: "The Evolution of Muscle Specialization in Recent Coleoids". Keynote Lecture. Abstract: *Berliner Paläobiologische Abhandlungen* **01:** 54-57.

Society for Integrative and Comparative Biology Annual Meeting, Toronto, Canada, January 2003: "Hydrostatic Skeletons in the Crustacea". (co-authored with

J.R.A. Taylor, presenter). Abstract: *Integrative and Comparative Biology* **42:** 1322.

Society for Integrative and Comparative Biology Annual Meeting, Toronto, Canada, January 2003: "Peristaltic Locomotion in Holothuroids (Echinodermata)". (co-authored with D.D. Spain, presenter). Abstract: *Integrative and Comparative Biology* **42:** 1316.

TEDMED Conference, Philadelphia, PA, June 12, 2003. Invited Presenter.

Society of Laparoendoscopic Surgeons 12th International Congress and Endo Expo, Las Vegas, NV, September 25, 2003: "Nature's Flexible Manipulators: Learning from the Octopus and Squid". Keynote Lecture. Abstract: 12th International Congress and Endo Expo: SLS Annual Meeting Syllabus, Las Vegas, Nevada, USA, September 22-25, 2003. Miami, FL: Society of Laparoendoscopic Surgeons; 2003:33.

Society for Integrative and Comparative Biology Annual Meeting, San Diego, CA, January 2005: "The Morphology and Mechanics of Octopus Arms: Inspiration for Novel Robotics". (co-authored with M.P. Stella, presenter). Abstract: *Integrative and Comparative Biology* **44**: 645.

Society for Integrative and Comparative Biology Annual Meeting, San Diego, CA, January 2005: "Hydrostatic Support in a Land Crab". (co-authored with J.A. Taylor, presenter). Abstract: *Integrative and Comparative Biology* **44**: 651.

Society for Integrative and Comparative Biology Annual Meeting, San Diego, CA, January 2005: "The Function of Cephalopod Buccal Mass Musculature". (co-authored with T.A. Uyeno, presenter). Abstract: *Integrative and Comparative Biology* **44**: 757.

Society for Integrative and Comparative Biology Annual Meeting, Orlando, FL, January 2006. "Mechanical Properties of a Crab Skeleton Following Molting". (co-authored with J.A. Taylor, presenter). Abstract: *Integrative and Comparative Biology* **45**: 1082.

Society for Integrative and Comparative Biology Annual Meeting, Orlando, FL, January 2006. "The Muscle Articulation in Polychaetes and Cephalopods: Joints Made of Multifunction Muscle". (co-authored with T.A. Uyeno, presenter). Abstract: *Integrative and Comparative Biology* **45**: 1088.

Society for Integrative and Comparative Biology Annual Meeting, Orlando, FL, January 2006. "Specialization for Fast Contraction in the Tentacle Muscle of the Cuttlefish, *Sepia officinalis*". (co-authored with M. P. Stella, presenter). Abstract: *Integrative and Comparative Biology* **45**: 1198.

5th World Congress of Biomechanics, Munich, Germany, August, 2006. Invited Presenter. Muscle Specialization in the Squid Motor System. Abstract: *Journal of Biomechanics* **39**: S353.

Society for Integrative and Comparative Biology Annual Meeting, Phoenix, AZ, January 2007. "The Structure of the Hooks of a Turbellarian Flatworm: A Vermetically Sealed Muscle Articulation". (co-authored with T.A. Uyeno, presenter). Abstract: *Integrative and Comparative Biology* **46**: e145.

Society for Integrative and Comparative Biology Annual Meeting, Phoenix, AZ, January 2007. "Alternative Splicing of the Myosin Heavy Chain in *Loligo*: a *Squid Pro Quo* Protein Distribution". (co-authored with F. H. Schachat). Abstract: *Integrative and Comparative Biology* **46**: e215.

Society for Integrative and Comparative Biology Annual Meeting, Phoenix, AZ, January 2007. "Interactions of ambient and feeding currents in the branchial crown of the "Christmas tree worm", *Spirobranchus giganteus*. (co-authored with L.D. Waldrop, presenter). Abstract: *Integrative and Comparative Biology* **46**: e262.

1st International Congress of Invertebrate Morphology, Copenhagen, Denmark, August, 2008. "Invertebrate muscle specialization: morphological modulation in squid".

Society for Integrative and Comparative Biology Annual Meeting, Boston, MA, January 2009. "You can hide, but you can't run: trade-offs between muscle activation and transparency in glass catfish." (co-authored with S. Johnsen, presenter). Abstract: *Integrative and Comparative Biology* **49**: e86.

Society for Integrative and Comparative Biology Annual Meeting, Charleston, SC, January 2012. "Tuning of mantle connective tissue to non-uniform strain in the squid Doryteuthis pealeii." [co-authored with J.A. Kurth (presenter) and J. T. Thompson].
"Non-uniform strain in squid mantle muscle: relating the length-tension curve to in-vivo muscle performance." [co-authored with J.T. Thompson (presenter) and R. M. Shelton].
"Muscular tissues in the squid Doryteuthis pealei express identical myosin heavy chain isoforms". [co-authored with J.F. Shaffer (presenter)]
"Using research focused learning modules for outreach to high school science classrooms". [co-authored with A.L. Safarti (presenter), J.F. Shaffer, W.M. Kier, and J.S. Coble].

Society for the Neural Control of Movement Annual Meeting, Venice, Italy, April, 2012. "Morphology and biomechanics of muscular hydrostats". Invited Symposium Presentation.

Society for Experimental Biology Annual Meeting, Salzburg, Austria, June, 2012. "Structural modulation of shortening velocity in cephalopod muscle". Invited Symposium Presentation.

Living Machines, The International Conference on Biomimetic and Biohybrid Systems, Barcelona, Spain, July, 2012. "Morphology and biomechanics of muscular-hydrostats". Invited Symposium Presentation.

Southeast Regional Meeting of the Society for Integrative and Comparative Biology, Charleston, SC, October 2012, "Fast and slow squid muscle: an integrative analysis of fiber evolution and specialization". Keynote Address.

Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, January 2013, "Scaling of the hydrostatic skeleton in the earthworm, *Lumbricus terrestris*." [co-authored with J.A. Kurth (presenter)].

Society for Experimental Biology Annual Meeting, Valencia, Spain, July, 2013. "Coleoid cephalopods do not express tissue-specific myosin heavy chain isoforms". (co-authored with J.F. Shaffer).

Society for Integrative and Comparative Biology Annual Meeting, Austin, TX, January 2014. "Clearly camouflaged: muscle architecture in transparent shrimp." [co-authored with S. Johnsen and L.E. Bagge (presenter)].
"Bigger is not better: the effects of body size on 3D burrowing kinematics in the earthworm *Lumbricus terrestris*." (co-authored with J.A. Kurth)

34th International Ethological Conference, 2015, Cairns, Australia, August 2015. "Diversity, morphology and biomechanics of muscular hydrostats". Invited Symposium Presentation.

Experimental Biology Conference, San Diego, CA, April 2016. "The function of oblique striation explained? Tuning the length-force relationship in the muscles of soft-bodied invertebrates." Invited symposium presentation, [co-authored with J.T. Thompson (presenter)]

Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, January 2018. "Structure and shape affect obliquely striated muscle function in soft-bodied invertebrates." Invited symposium presentation, [co-authored with J.T Thompson and K.R. Taylor-Burt (presenters)]

Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, January 2018. "The ultrastructure of transparent shrimp." [co-authored with L.E. Bagge (presenter) and S. Johnsen]

Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, January 2018. "Excitability of transverse tentacle versus arm muscle fibers in the squid *Doryteuthis opalescens*." (poster co-authored with W.F. Gilly, O.V. Drake, and L. Gregg).

Society for Integrative and Comparative Biology Annual Meeting, Tampa, FL, January 2019. "Clearly camouflaged: ultrastructural modifications in transparent animals." [co-authored with L.E. Bagge (presenter), S.E. Kinsey and S. Johnsen].

Robosoft 2021, Institute of Electrical and Electronics Engineers (IEEE) International Conference on Soft Robotics. Soft Continuum Systems in Nature and Robotics: Biological and Artificial Intelligence through Materials, Sensing, Actuation and

Control. April 2021, Yale University, New Haven, CT. “Principles of structure and function of muscular hydrostats.” Invited Symposium Presentation.

Biomechanics in Nature, Society for Experimental Biology, Wageningen, The Netherlands, May 11, 2023. “Not only for superelongation: diversity of length-force properties of obliquely striated muscles.” (co-authored with J.T. Thompson and K.R. Taylor-Burt)