

CURRICULUM VITAE

Andrew Austin Biewener
Charles P. Lyman Professor of Biology
Director, Concord Field Station

PERSONAL:

Birthdate: 4 September 1952
Citizenship: U.S.A.
email: biewener@fas.harvard.edu

EDUCATION:

1974	B.S. Zoology (<i>magna cum laude</i>)	Duke University, Durham, North Carolina
1981	M.A. Biology	Harvard University, Cambridge, Massachusetts
1982	Ph.D. Biology	Harvard University, Cambridge, Massachusetts

RESEARCH AND TEACHING POSITIONS:

1998 – present	Charles P. Lyman Professor of Biology and Director, Concord Field Station, Museum of Comparative Zoology, Department of Organismic and Evolutionary Biology, Harvard University
2001 – 2010	Chair, Department of Organismic and Evolutionary Biology, Harvard University
1999 – 2002	Curator of Birds and Mammals, Museum of Comparative Zoology, Harvard University
1995 – 1998	Professor & Chair, Department of Organismal Biology & Anatomy, The University of Chicago
1995 – 1998	Professor, The Committee on Evolutionary Biology, The University of Chicago
1990 – 1995	Associate Professor, Department of Organismal Biology and Anatomy and The Committee on Evolutionary Biology, The University of Chicago
1984 – 1990	Assistant Professor, Department of Organismal Biology and Anatomy, The University of Chicago
1985 – 1990	Assistant Professor, The Committee on Evolutionary Biology, The University of Chicago
1982 – 1984	Instructor, Anatomy Department, The University of Chicago

(Declined)

2018-2023 US Office of Naval Research #N00014-18-S-F006 Active Perception and Knowledge Exploitation in Navigation and Spatial Awareness MURI: “APEX: Building Neural and Cognitive Models of Data-rich Knowledge Representation and Exploitation” Subcontract Biewener/Harvard \$997,747 (5 years)

(Declined)

2018-2023 US Army #N00014-17-S-F006 Embodied Learning and Control: DOD MURI: “AGILE, NON-EQUILIBRIUM CONTROL OF SENSOR- AND ACTUATOR-RICH SYNTHETIC SYSTEMS” Subcontract: Biewener/Harvard \$1,175,000 (5 years)

(Funded)

2021-2025 National Institutes of Health “A system for long-term high-resolution 3D tracking of movement kinematics in freely behaving animals” R01 GM136972-01 \$1,796,812 direct costs. PI: Bence Olveczky (AA Biewener role: co-I, 0.5 mo/yr).

2017-2018 David Rockefeller Center for Latin American Studies (DRCLAS) “Tail use in static postural support and jumping locomotion of jerboas (*Jaculus jaculus*)” \$30,000

2014 - 2018 National Institutes of Health, “Assessment and evaluation of Hill-type muscle models for predicting in vivo force” R01 AR055648-04, 4 years (\$1,302,340) [Role: PI] Allison Arnold-Rife, co-PI
(subcontract: Simon Fraser University – James Wakeling, co-PI: \$397,726)

2010 – 2016 ONR MURI (Dept. of Defense) “Provably-Stable Vision-Based Control of High-Speed Flight Through Forests and Urban Environments Using Various Avian Models” N0014-10-1-0951, \$4.5M; subcontract via M.I.T. Proposal No. 00007058 (\$137,500/yr) [Role: co-PI]

2014-2016 National Geographic Society “Ecomorphology and flight performance during high-speed maneuvers in swallows.” NGS #9402-13 (\$20,000 co-PI, with B. Tobalske & D. Warrick – PIs and T. Hedrick co-PI)

2008 - 2013 National Institutes of Health, “Assessment and evaluation of Hill-type muscle models for predicting in vivo force” R01 AR055648, 5 years (\$1,500,482) [Role: PI]
(subcontract: Simon Fraser University – James Wakeling, co-PI: \$397,726)

2008 - 2012 National Science Foundation, Integrative Organismal Systems Program, "Neuromuscular and Kinematic Mechanisms of Avian Maneuvering Flight", 4 years IOS-0744056 (\$394,612) (Includes special NSF *Innovation Grant* as part of Yrs 3&4) [Role: PI]

2005 – 2006 National Institutes of Health, Symposium R13 Grant: “Neuromechanics: An Interdisciplinary Approach for Understanding Motor Control” (\$10,550) [Role: co-PI]

2003 - 2008 National Institutes of Health, “Locomotor Dynamics of Muscle Function” R01 AR47679, 5 years (\$1,501,250) [Role: PI]

2003 – 2008 DARPA BioDynamics “BigDog” \$405,000 (sub-contract to Boston Dynamics) BIOD_0010_2003 (BAA #01-42) [Role: co-PI]

- 2003 - 2008 NSF IGERT DGE 0221682 "Integrated Training Program in Biomechanics", 5 years (\$2,676,379) [Role: co-PI]
- 2003 - 2004 NSF Instrumentation "Volumetric Digital Particle Imaging Velocimetry (V-DPIV)" (\$195,000) [Role: co-PI]
- 2001 - 2005 National Science Foundation, Integrative Animal Biology Program, "Muscle Function during Avian Flight", 4 years IBN 0090265 (\$ 367,000) [Role: PI]
- 2001 National Science Foundation, Physiology and Behavior Program, "In Vivo Muscle Mechanics during Locomotion - II", Supplement Award (\$ 6,200) [Role: PI]
- 1997 - 2000 National Science Foundation, Physiology and Behavior Program, "In Vivo Muscle Mechanics during Locomotion - II", 3 years (\$ 150,000) [Role: PI]
- 1997 - 2000 National Science Foundation, Major Research Infrastructure, "Acquisition of a Light Microscopy and Digital Imaging Facility", 3 years (\$ 587,297) [Role: co-PI]
- 1997 - 1999 National Science Foundation, Dissertation Improvement Grant, "Ontogeny and Evolution of Frog Hind Limb Bone Morphology and Material Properties: Effects of Variation in Developmental Duration on Jumping Performance", 2 yrs (\$ 10,000) [co-PI with N. Espinoza]
- 1995 - 1997 National Science Foundation, Dissertation Improvement Grant, "A Biomechanical Examination of the Evolution of Therapsid Hind Limb Posture", 2 yrs (\$ 11,200) [co-PI with R. Blob & J. Hopson]
- 1994 - 1997 National Science Foundation, Physiology and Behavior Program, "Mechanics of in vivo muscle function during locomotion", 3 years (\$ 221,097) [Role: PI]
- 1993 - 1994 National Science Foundation, Multiuser Biological Equipment Program, "Acquisition of a Kodak Ektapro high speed video system", (\$ 157,564) [Role: PI] (co-PI's: M. Dickinson, M. LaBarbera & M. Westneat)
- 1991 - 1995 National Institutes of Health, Orthopaedic and Musculoskeletal Research Section, "Effects of exercise on bone modeling during growth", 4 years (\$ 322,848 - direct costs) [Role: PI]
- 1991 - 1993 National Science Foundation, Physiological Processes, "Stress similarity and the biomechanics of terrestrial locomotion", 2 years (\$ 90,000) [Role: PI]
- 1986 - 1989 National Science Foundation, Regulatory Biology, "Scaling locomotor mechanics: the effect of limb posture", 3 years (\$ 170,087) [Role: PI]
- 1983 - 1986 The Whitaker Foundation, Camp Hill, PA, "Influence of function on the post-natal development of bone" (\$ 115,398) [Role: PI]
- 1982 - 1983 Biomedical Research Support Fund, The University of Chicago: "Bone loading during locomotion and growth" (\$ 13,900) [Role: PI] Collaborative Post-Doctoral/Research Associate Grants

- 2009-2012 (with Allison Arnold-Rife) National Institutes of Health, *Career Re-entry Grant* linked to “Assessment and evaluation of Hill-type muscle models for predicting in vivo force” R01 AR055648. 3 years (\$ 265,000)
- 2001-2003 (with Anna Ahn) NRSA, F32 AR47741 National Institutes of Health, “Muscle function during different locomotor activities”, 3 years (\$108,288)
- 2001-2003 (with Ryan J. Monti) NRSA, F32 AR08646 National Institutes of Health, “Influence of muscle architecture on in vivo performance”, 3 years (\$ 108,288)
- 1998-2001 (with G. B. Gillis) NRSA, F32 AR08559 National Institutes of Health, “Plasticity of limb muscle function during locomotion”, F32 AR08559 3 years (\$ 93,420)
- 1996 – 1999 (with D. Konieczynski) National Institutes of Health, First Award, “Effects of daily loading and growth on bone adaptation”, 5 years (\$ 347,428 direct costs) declined

Collaborative/Consultant Research Grants

- 2000-2004 (with D.F. Hoyt, PI and S. J. Wickler, co-PI, California St. Polytechnic University, Pomona) National Institutes of Health, NIGMS “Muscle function during terrestrial locomotion”, 4 years (\$ 378,050 direct costs) SCORE Program at Cal Poly Pomona (1 S06 GM53933)
- 1996-2000 (with D.F. Hoyt, PI and S. J. Wickler, co-PI, California St. Polytechnic University, Pomona) National Institutes of Health, NIGMS “Muscle function during terrestrial locomotion”, 4 years (\$ 319,401 direct costs)
- 1994-1999 (with C.R. Taylor) Harvard University, NIH “Locomotion: idling metabolism and gait dynamics”, 5 years (\$ 763,051 direct costs) 2 RO1 AR18140-17

OTHER PROFESSIONAL ACTIVITIES:

- 2021 Guest Editor, Theme Issue: *Stability and manoeuvrability in animal movement: lessons from biology, modelling, and robotics*, *Proceedings of the Royal Society, B*
- 2021 American Society of Biomechanics, ASB Fellows Nomination Review Committee
- 2005 – 2021 Deputy Editor-in-Chief, *Journal of Experimental Biology*
- 2001 – 2005 Editor, *Journal of Experimental Biology*
- 2008, 2012, 2014, 2015, 2018, 2019, 2021 Guest Editor, *Proceedings of the National Academy of Sciences*
- 2006 – 2012 Editorial Board, *Biology Letters (Royal Society of London)*
- 2013 – 2017 External Scientific Advisory Board Member, Tufts University *Soft Materials Robotics IGERT Program*

2013 – 2017	Scientific Advisory Committee Member, Whitney Laboratory for Marine Science, Univ. of Florida
2006 – 2012	Biomechanics Section Head, Locomotion Commission, <i>International Union Physiological Science</i> (Kyoto-2009)
2001– 2002	President, American Society of Biomechanics
2000 – 2001	President-elect, American Society of Biomechanics
1999 – 2001	Chair, Division of Vertebrate Morphology, Society for Integrative and Comparative Biology
1992 – 1993	Program Chair, American Society of Biomechanics
1996 – 2002	Editorial Board, <i>Physiological & Biochemical Zoology</i>
1995 – 2001	Editorial Board, <i>Journal of Experimental Zoology</i>
1999 – 2005	Editorial Board, <i>Journal of Morphology</i>
1988 – 2000	Editorial Board, <i>Cells, Tissues & Organs</i>

Invited Review (Professional Journals and *Ad hoc* for Granting Agencies:

eLife, Journal of Applied Physiology, Journal of Biomechanics, Journal of Experimental Biology, Journal of Morphology, Journal of Orthopedic Research, Journal of Theoretical Biology, Nature, Current Biology, Physiological Zoology, PNAS, Proceedings Royal Society B, Royal Society Interface, Science, Frontiers in Physiology, Frontiers in Neuroscience, Integrative Comparative Biology

NSF grant *ad hoc* review: Integrative Biology & Neuroscience Panel and Physical Anthropology Panel, Integrative Organismal Systems

BBSRC (UK) – *ad hoc* grant review
NSERC (Canada) – *ad hoc* grant review

Federal Grant Study Sections/Review Panels:

2014 – 2015	<i>Chair</i> , Musculoskeletal Rehabilitation Sciences Study Section, National Institutes of Health
2011 – 2015	<i>Regular</i> member of Musculoskeletal Rehabilitation Sciences Study Section, National Institutes of Health
2008 (Fall)	NSF Panel Member: <i>Physiological and Structural Systems, Division of Integrative Organismal Systems</i>
2004 – 2010	<i>Ad hoc</i> member of Musculoskeletal Rehabilitation Sciences Study Section, National Institutes of Health
2002	<i>Ad hoc</i> member of National Research Service Awards (NRSA) Panel, National Institutes of Health

NSF (Fall) Panel Member: *Integrative Animal Biology*

1999, 2001 *Ad hoc* member of Geriatrics and Rehabilitative Medicine Panel, National Institutes of Health

University Service:

2017 – 2018 Graduate Admissions Committee, Department of Organismic and Evolutionary Biology, Harvard University

2013-14 Harvard University, Graduate School of Arts & Sciences (GSAS), Task Force on Science Ph.D. Programs within the Faculty of Arts & Sciences (FAS), Co-Chair

2007 – 2010 Harvard University: Science Council

2001 – current Harvard University, FAS, Institutional Animal Care and Use Committee (IACUC)

2006 Harvard University, FAS College Dean Search Committee

2007 – 2008 Harvard University, FAS, Pedagogy Committee

2006 – 2007 Harvard University, FAS Task Force, Teaching & Career Development

2006 –2007 Harvard University Planning Committee for Science and Engineering (UPCSE)

2005 – 2007 Harvard University, FAS Chairs Caucus

2004 – 2007 Harvard University: Life Sciences Executive Committee

2001 – 2010 Chair, Department of Organismic and Evolutionary Biology, Harvard University

2000 – 2001 Harvard University: Faculty Council

2001 – 2003 Harvard University: Neuroscience Center Director Search & Advisory Committee

1992 Committee to Review Dept. of Anesthesia & Critical Care, University of Chicago

1989 Undergraduate Research Opportunities in Biological Sciences, The University of Chicago

1984 – 1985 Task Force on Physical Education, The University of Chicago

Professional Society Service:

2016-17 Society for Integrative and Comparative Biology: *ICB-Open* Editor-in-Chief Search Committee

- 2010 Meeting Organizing Committee Member, American Physiological Society: Intersociety Meeting: *Global change and global science: comparative physiology in a changing world.*
- 2010 Meeting Organizing Committee Member, International Congress on Vertebrate Morphology, ICVM-9, Punta del Este Uruguay.
- 1992 – 1993 Executive Board Member, American Society of Biomechanics
- 1986 – 1987 Membership Committee, American Society of Biomechanics

DOCTORAL STUDENTS TRAINED (19 total):

- Philip Fahn-Lai (2021) Harvard, PhD Thesis: “Shoulder to shoulder: Musculoskeletal function of the amniote pectoral girdle and the foundations of the mammalian forelimb”
current position: **Data Design Scientist**, Harvard Chan School of Public Health
- Kari Taylor-Burt (2020) Harvard, PhD Thesis: “How to waddle with a paddle: a study of duck hindlimb anatomy, kinematics, and muscle function across behaviors and species”
current position: **Assistant Professor**, Mount St. Mary's University
- Brianna McHorse (2019) Harvard, PhD Thesis: “Macroevolution and biomechanics of digit reduction in horses.” (Stephanie Pierce co-advisor)
current position: Data Scientist, AI-powered games
- Clifton T. Glenna (2017) Harvard, PhD Thesis: “Anatomical patterns, kinematics, and propulsive strategies of foot-based swimming birds.”
current position: **Assistant Professor**, Department of Biology, University of Portland
- Moore, Talia Y. (2016) (Jonathan Losos co-advisor) Harvard, PhD Thesis: “An Integrative Investigation of Convergent Bipedal Locomotion in Desert Rodents”
current position: **Assistant Professor**, Robotics and Mechanical Engineering, University of Michigan
- Eng, Carolyn M. (2014) (Daniel Lieberman co-advisor) Harvard, PhD Thesis: “An anatomical and biomechanical study of the human iliotibial band’s role in elastic energy storage”
current position: **Project Manager**, Kaiser-Permanente Health
- Ros, Ivo G. (2013) Harvard, Ph.D. Thesis: “Low Speed Avian Maneuvering Flight”
current position: **Research Associate**, Bioengineering, Cal. Tech.
- Moreno, Carlos A. (2010) Harvard, Ph.D. Thesis: "Biomechanics of non-steady locomotion: bone loading, turning mechanics and maneuvering performance in goats"
Past position: **Computer technical analyst**: Technical Analyst, Daedalus Software
- Berg, Angela M. (2010) Harvard, Ph.D. Thesis: "Kinematics, aerodynamics and neuromuscular function of avian flight: takeoff and landing, ascent and descent."
Past academic position: **Post-doctoral fellow** (Univ. of Houston Medical Center)

- Richards, Christopher (2009) Harvard, Ph.D. Thesis: "Muscle mechanics and hydrodynamics of swimming anurans"
current position: **Senior Lecturer** (RVC, Univ. London)
- Main, Russell (2006) Harvard, Ph.D. Thesis: "Skeletal biomechanics, histomorphology and growth in tetrapods"
current position: **Associate Professor**, Division of Clinical Basic Sciences, Purdue University
- Daley, Monica A. (2006). Harvard, Ph.D. Thesis: "Dynamic stability of running over rough terrain: the role of limb posture and distal limb muscle performance"
current position: **Associate Professor**, Ecology and Evolutionary Biology, Univ. California, Irvine
- McGowan, Craig P. (2006) Harvard, Ph.D. Thesis: "Musculoskeletal design in macropodoid marsupials: implications for acceleration mechanics, body size and habitat use"
current position: **Associate Professor**, Keck School of Medicine, Univ. Southern California
- Hedrick, Tyson L. (2004) Harvard, Ph.D. Thesis: "Aerodynamics, biomechanics and neuromuscular control of avian flight"
current position: **Professor** of Biology (UNC, Chapel Hill)
(previously: NSF Bioinformatics Post-doctoral fellow (Prof. Tom Daniel, Dept. of Zoology, Univ. Washington))
- Espinoza, Nora J. (2000) Univ. Chicago, Ph.D. Thesis: "Ontogenetic scaling, musculoskeletal development and jump performance of anurans in relation to developmental rate"
current position: **Senior Lecturer**, Department of Biology, Clemson University
- Blob, Richard W. (1998) Univ. Chicago Ph.D. Thesis: "A Biomechanical Examination of the Evolution of Therapsid Hindlimb Posture"
current position: **Professor**, Department of Biology, Clemson University
- Carrano, Matthew T. (1998) Univ. Chicago Ph.D. Thesis: "The Evolution of Dinosaur Locomotion: Functional Morphology, Biomechanics, and Modern Analogs"
current position: **Curator of Dinosaurs**, Smithsonian Nat. Museum, Washington DC
- Frolich, Lawrence M. (1991) Univ. Chicago Ph.D. Thesis: "The Evolution of Terrestrial Locomotion: Functional Morphology of the Body Axis in Salamanders"
Past academic position: **Assistant Professor**, Bristol College
- Bertram, John E. A. (1988) Univ. Chicago Ph.D. Thesis: "The Biomechanics of Bending and its Implications for Terrestrial Support"
current position: **Professor**, Anatomy and Cell Biology Department, University of Calgary
- Swartz, Sharon M. (1988) Univ. Chicago Ph.D. Thesis: "Skeletal Biomechanics of Suspensory Support in Primates"
current position: **Professor**, Evolutionary Biology and Ecology, Div. Biology & Medicine, Brown University
- Jaslow, Carolyn B. (1987) Univ. Chicago Ph.D. Thesis: "A Functional Analysis of Skull Design in the Caprini"

current position: **Professor**, Biology, Rhodes College

MASTERS STUDENTS TRAINED:

- Kohler, Janis (1993) M.A., Committee on Evolutionary Biology, Univ. of Chicago; Veterinary Medicine
(current: unknown)
- Temaner, Marco (1996) Organismal Biology and Anatomy, Univ. Chicago, M.A.: computer software
(current: unknown)
- Corning, William (1997) Univ. of Chicago M.A., Organismal Biology and Anatomy, Univ. of Chicago;
Oregon St. Fish & Wildlife (current: unknown)
- Yoo, Edwin (2009) M.A., Organismic and Evolutionary Biology, Harvard University; public high school
science teacher

DOCTORAL DISSERTATION DEFENSE COMMITTEES: (Current Position)

Yordano Jimenez (Beth Brainerd, PhD Advisor)	EEB, Brown Univ.	2021	Post-Doc, Tufts University
Andrew Yegian (D Lieberman, PhD Advisor)	HEB, Harvard	2019	College Fellow, HEB Harvard
Dylan Wainwright (G. Lauder PhD Advisor)	OEB, Harvard	2019	NSF Post-Doc, Yale
Mary Salcedo (L. Mahadevan & S. Combes, PhD Advisors)	OEB Harvard	2019	NSF Post-doc, VA Tech.
Kelsey Lucas (P. Girguis & G. Lauder*, PhD advisors)	OEB Harvard	2019	
Jacob Peters (L. Mahadevan & S. Combes, PhD Advisors)	OEB Harvard	2018	Post-doc, Cornell University
Callin Switzer (S. Combes & Robin Hopkins, PhD Advisors)	OEB Harvard	2017	Post-doc, Univ. Washington Data Analyst, Microsoft Corp.
Eric Castillo (D Lieberman, PhD Advisor)	HEB, Harvard	2017	Postdoctoral Fellow
Kara Feilich (G V Lauder, PhD Advisor)	OEB, Harvard	2017	Post-doc, Univ. Michigan
James Crall (S. Combes, PhD Advisor)	OEB Harvard	2016	Post-doc, OEB, de Bivort Lab, Harvard University

Brian Addison (D Lieberman, PhD Advisor)	HEB, Harvard	2016	
Erin Blevins (G V Lauder, PhD Advisor)	OEB, Harvard	2012	Harvard College Lecturer
Neil Roach (Dan Lieberman, PhD Advisor)	HEB, Harvard	2012	Lecturer, HEB, Harvard College
Emily Standen (G V Lauder, PhD Advisor)	OEB, Harvard	2008	Assistant Professor, Univ. Ottawa
Brooke Flammang (G V Lauder, PhD Advisor)	OEB, Harvard	2009	Assistant Professor, Rutgers Univ.
Nicola Smith [outside examiner]	Royal Veterinary College, UK	2006	Research Scientist
Laura Gibson [outside examiner]	Psychology, Harvard	2006	"Person Perception of Point-light Walkers"
Herman Pontzer	BioAnthropology, Harvard	2006	Professor, Anthropology, Hunter College, CUNY
Kristin Bishop [outside examiner]	Ecology & Evol., Brown	2006	Assoc. Professor, Clark Univ.
S. Tonia Hsieh	OEB, Harvard	2006	Assoc. Professor, Temple University
Leon Claessens	OEB, Harvard	2005	Assoc. Professor, Biology, Holy Cross
Eric Tytell	OEB, Harvard	2005	Asst. Professor, Biology, Tufts Univ.
James C. Liao	OEB, Harvard	2004	Assoc. Professor, Whitney Lab, Univ. Florida
Tomasz Owerkowicz	OEB, Harvard	2003	Asst. Professor, Cal. St. Univ., San Bernardino
Matthew Thompson	OEB, Harvard	2003	Post-doc
Paul M. Magwene	CEB, Univ. of Chicago	1999	Professor, Biology, Duke University
Howard Doong "Force transduction of fibroblasts: effects on cellular activity"	OBA, Univ. of Chicago	1997	Research Associate, N.I.H.
Timothy Gaudin	OBA, Univ. of Chicago	1995	Professor, Biology, Univ. Tenn. Chattanooga
Thomas J. Roberts	OEB, Harvard University	1995	Professor, Biology

[outside examiner]			Brown Univ.
Claire Farley [outside examiner]	OEB, Harvard University	1992	Assoc. Professor, Physiology, Univ. of Colorado, Boulder
Melina Hale	OBA, Univ. of Chicago	1998	Professor, OBA, Univ. Chicago
Daniel McShea	Comm. Evol. Biology Univ. of Chicago	1992	Professor, Biology, Duke Univ.
Suzanne Kamel	Organismal Biol. & Anatomy	1988	
Peter Wainwright	Organismal Biol. & Anatomy University of Chicago	1986	Professor, UC, Davis

PAST POST-DOCTORAL TRAINEES (Current Position)

Chris Tijs (PhD. Free University, Amsterdam, The Netherlands)	Data analyst – Netherlands Translink
Nicolai Konow (Research Associate)	Assistant Professor, Univ. Massachusetts (Lowell)
Allison Arnold-Rife (Research Associate) (PhD Northwestern, Post-doc, Stanford)	Biomechanics & Rehabilitation Science Consultant
Robert Kambic (2015-2017) (PhD. Brown University) (joint w/ S. Pierce)	Assistant Professor, Hood College
Partha Bhagavatula (2014-2016) (PhD. ANU)	Post-doctoral fellow, Univ. of Singapore
Ivo G. Ros (2013-15)	Postdoctoral Research Scholar, Cal. Tech
Carolyn M. Eng (2014-15)	Project Manager – Kaiser Permanente NW HealthCare
C. David Williams (2012-14)	Research Associate, Univ. Washington
Natalie C. Holt (2011-2013)	Assistant Professor, University of California, Riverside
Maria de Boef Miara (2008-2013)	Lecturer, Brandeis University
Huai-Ti Lin (2011-2012)	Senior Lecturer, Dept. of Bioengineering, Imperial College, London
David Lentink (2009-2010)	Professor, BioEngineering, University Groningen
Andrew Carroll (2005-08) (deceased)	Assistant Professor, Dept. of Biology, Evansville College

Timothy Higham (2006-08)	Assoc. Professor, Dept. of Biology, Univ. Calif., Riverside
David V. Lee (2003-06)	Assoc. Professor, Dept. of Biology, Univ. Nevada, Las Vegas
M. Polly McGuigan (2003-05)	Sr. Lecturer, University of Bath
James C. Usherwood (2002-04)	Reader, Royal Veterinary College, UK
Anna N. Ahn (2000-04)	Professor, Dept. of Biology, Harvey Mudd College
Barbekka Hurt (2003-04)	Post-doctoral, Environ. Physiology (Harvard SPH) – current??
Ryan J. Monti (2001-03)	UCLA School of Dentistry – current??
Gary Gillis (1998-02)	Professor, Dept. of Biology, Mt. Holyoke College
Bret W. Tobalske (1998-99)	Professor, Biological Sciences, University of Montana
David Konieczynski (1993-96)	Bioengineering Research Div., Johnson & Johnson Medical Systems, Inc.
Donald C. Dunbar (1986-88)	Professor, Dept. of Anatomy, Univ. of Puerto Rico Adjunct Professor, San Diego St. University

CURRENT DOCTORAL & POST-DOCTORAL TRAINEES:

Doctoral (Harvard University)

None - current

Post-Doctoral/Research Associate

None - current

Doctoral Committees (Harvard University)

Yurika Doi, (HMS/MCB Neuroscience, N. Uchida PhD Advisor)

Dave Matthews (OEB, G. Lauder PhD Advisor)

Zane Wolf (OEB, G. Lauder PhD Advisor)

Mark Wright (OEB, S. Pierce PhD Advisor)

Connor White (OEB, G. Lauder PhD Advisor)

Zhe He (OEB, Holbrook PhD advisor)

W. Eamon Callison (HEB, D. Lieberman PhD Advisor)

(Outside Harvard) None-current

TEACHING:

[Harvard University]

Life Sciences (LS) 2 *Evolutionary Human Physiology & Anatomy* (undergraduate: 150-200)

OEB (Bio) 173 *Comparative Biomechanics* (graduate/adv. undergraduate: 10-15)

Freshman Seminar 50H *The Biology of Movement* (10-12)

OEB (Bio) 102 *Structure and Physiology of Vertebrates* (undergraduate: 30-75)

OEB (Bio) 121a&b *Research in Comparative Biomechanics* (undergraduate: 10-15)

BioSci 51 *Integrative Biology of Organisms* (undergraduate: 200-250)

[University of Chicago]

Human Morphology and Histology (Pritzker School of Medicine)

Vertebrate Structure & Function (undergraduate/graduate)

Calcified Tissue Biology (graduate)

Animal Locomotion (graduate/adv. undergraduate)

Animal Biomechanics (graduate/adv. undergraduate)

Organismal Biology (undergraduate)

Undergraduate Thesis Research Students:

Nicholas Rizzo 1988 (University of Chicago)

Michael Williamson 1997 (Harvard Univ. Thesis: "Power requirements of flight in Anseriformes")

Hooman Kamel 1999 (Harvard Univ. Thesis: "Wing bone design & loading during flight in mallards")

Danielle Backes 2000 (Harvard Univ. Thesis: "Mechanics of flight take-off in mallards")

Raegan Hicks 2000 (Harvard Univ. Thesis: "Scaling of *in vivo* pectoralis force and activation during flight in columbids")

David (Harvard Univ. Thesis: "Scaling of *in vivo* pectoralis strain during flight in columbids")

John Flynn 2001 (Harvard Univ. Thesis: "Goat proximal hind limb muscle function versus speed and gait")

Rebecca Mitchell 2003 (Harvard Univ. Thesis: "Influence of locomotor pattern on ontogenetic scaling of limb bone geometry in birds")

Eva Furrow 2003 (Harvard Univ. Thesis: "In vivo muscle function of *Kassina maculata*: anuran walking versus running?")

Steven Leckie 2003 (Harvard Univ. Thesis: *Ontogeny of locomotor cost in emu*)

Arya Soman 2003 (Harvard Univ. Thesis: "Regional *in vivo* strain patterns in the pigeon pectoralis during flight")

Gladys Felix 2005 (Harvard Univ. Thesis: “Biomechanics and dynamics of stabilization following perturbed running in guinea fowl”)

Beverlie Ting 2006 (Harvard Univ. Thesis: “Biomechanics of climbing in goats”)

Jonah Todd-Geddes 2006 (Harvard Univ. Thesis: “Effects of monoamine-oxidase A (MOA-A) deficiency on locomotor performance in Tg8-C3D knockout mice”)

Anne Siders 2006 (Harvard Univ. Thesis: “Comparative ontogenetic patterns of bone growth in birds related to locomotor function”)

Jennifer Antonnen (Harvard Univ. Thesis (Physics): “Center of Pressure Migration at Trot and Gallop in Goats and Dogs”)

Jonathan Barr 2008 (Harvard Univ. Thesis: “A tail of two pigeons: examining the role of the tail in the takeoff and landing flight of the homing pigeon (*Columba livia domestica*)”)

Caroline Vloka 2012 (Harvard Univ. Thesis: “The Gastrocnemius Muscle as a Factor in Human Bipedalism”)

Alberto Rivera (2014) (Harvard Univ. Thesis: “The Role of Tendon Elastic Energy, Granular Substrate, and Pitch Stabilization in *J. Jaculus* Jumping”)

PUBLIC OUTREACH: LECTURES, EDUCATION & MEDIA

1990 CNN News “Animal Biomechanics”

1997 University of Chicago: Teacher/Adult Education Program
“Studying Animal Biomechanics”

1999 CLCT-Harvard Taylor Memorial Lecture Series on the Environment

2000 CLCT -Harvard Taylor Memorial Lecture Series on the Environment
Lecture: “Scaling: why size matters”

2001 CLCT -Harvard Taylor Memorial Lecture Series on the Environment

BBC “Animal Locomotion” (2 hour documentary film for the Free University, UK) July, 2001
Discovery Channel Canada – “Designing the Human Body” June 2001
(2 hour documentary)

Discovery Channel CNBC – “Are Birds Feathered Dinosaurs?” November, 2001

2002 NPR *All Things Considered* “Could *T. rex* run?”

2002 *Science News* (vol. 161: p. 131) “Analysis hints *T. rex* ran slowly, if at all”

N.Y. Times TV: *Biomimicry, Design of Nature*, Science Times documentary for National Geographic

NBC Discovery Channel: *Wild Moments* “Animal Locomotion”

CLCT – Harvard C. Richard Taylor Memorial Lecture Series on the Environment

- 2003 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
- 2004 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
N.Y. Times “*Running with bent knees*”
- 2005 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
- 2006 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
- 2007 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
New York Academy of Sciences (April) *Art and Science Conference: **Biology and Art: Two Worlds or One?*** Talk: *Economy and Flexibility of Animal Locomotion* (paired with Theo Jansen, kinetic sculptor)
- 2008 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
- 2009 CLCT – Harvard Taylor Memorial Lecture Series on the Environment
Discovery TV: "World of Impact" High-speed motion analysis of hummingbird flight.
- 2010 “Control and dynamics of animal movement” *Biology Letters* special feature June, 2010
Organised by Andrew Biewener and Tom Daniel. Video Podcast:
http://rsbl.royalsocietypublishing.org/site/misc/animal_movement.xhtml
- Harvard Museum of Natural History: Gallery Lecture and Tour "Investigating comparative and evolutionary aspects of animal locomotion: from flight to hopping and jumping"
- CLCT – Harvard Taylor Memorial Lecture Series on the Environment
- Boston Globe: Karen Weintraub (August 1st) *Pigeons’ ‘beautiful’ navigation skills studied to improve tiny spy planes.* (linked to ONR-sponsored research project)
- 2011 **NPR**, Science Friday (12-2-2011) (Ira Flatow and Flora Lichtman) *Flight of the wild pigeon.*
[web link](#)
ScienceNow *Whirlybirds (11-28-2011)* [web link](#)
NewScientist (11-28-2011) *Pigeons are more living helicopters than flying rats* [web link](#)
CBC (Canada) Radio *Quirks and Quarks* science program 11-30-2011)
- (above media reports linked to Ros et al. *PNAS* paper)
- CLCT – Harvard Taylor Memorial Lecture Series on the Environment
- 2013 **ScienceNOW Science News** Aerial Acrobats: Pigeons Whoosh Through Tight Space (1-8-2013)
by Elizabeth Pennisi. (C. D. Williams and A. A. Biewener, SICB 2013 presentation) [web link](#)
- 2014 **National Geographic Channel** Hyper.Connection, Episode 6 (Stephen Hawking’s *Science of The Future*) Coverage of Harvard-MIT ONR-MURI robust flight through clutter (Ivo Ros, Biewener Lab Harvard-CFS & Tedrake Lab, CSAIL MIT)

- 2015 **ScienceNOW Science News** “Flying animals can teach drones a thing or two” (1-24-2015) by Nsikan Akpan (Hedrick, Biewener, Tedrake and others: ONR-MURI collaborative research on bird flight and UAVs) [web link](#)
- ScienceNOW L.A. Times** “View to a kill: Helmet-wearing hawk films its own hunting tactics” (1-23-2015) by Amina Khan (Interview re: *J Exp. Biol.* paper by Kane et al. 2015) [web link](#)
- Science Take N.Y. Times** “Tiny Masters of Turbulent Air” (3-16-2015) by James Gorman (related to Ravi et al. *JEB* 2015) [web link](#)
- Concord Land Conservation Trust** – C. Richard Taylor Memorial Environmental Lecture (April 6th): “How does Animal Movement Inspire Biorobotics?”
- Inside JEB** “Slap keeps rushing grebes afloat” Kathryn Knight *J Exp Biol* 2015 218:1113 (April, 2015)
- Science Magazine** (online) “How do these birds run on water?” Emily DeMarco (April, 2015) [web link](#)
- Nature**, Research Highlights - Biomechanics “How grebes walk on water” **520**, 508 (April, 2015) doi:10.1038/520588a [web link](#)
- Discovery Channel Canada** “Daily Planet” (April, 2015) [web link](#)
- Physics Today** “Diving bird runs on water to attract a mate” (April 23, 2015) [web link](#)
- Daily Mail** “Jesus' birds walk on the surface of ponds by slapping their feet up to 20 times a second” (May, 2015) [web link](#)
- Harvard Gazette** “Why birds don't crash” Peter Ruell, Science/Health – Life Sciences (April, 2015) [web link](#)
- Boston Globe** “Pigeons need to know just two things to avoid collisions” Keven Hartnett, Ideas – (April, 2015) [web link](#)
- 2017 **Harvard Gazette** “Understanding the IT Band” Peter Ruell, Science/Health (August, 2015) [web link](#)
- The Guardian** “How the horse became the only living animal with a single toe” (Nicola Davis, Aug, 2017) [web link](#)
- N. Y. Times Trilobites:** “How Horses Got Their Toes” (Steph Yin, Aug, 2017) [web link](#)
- Daily Mail** “How the horse lost its toes: Creature evolved hooves 5 million years ago to gallop faster after moving from protected forests to open grassland (Victoria Allen, Aug 2017) [web link](#)

SELECTED INVITED LECTURES/SEMINARS:

Johns Hopkins University, Dept. of Mechanical Engineering (Feb, **2020**). “*Neuromechanics and biorobotics: achieving stability and robust control for navigating complex environments.*”

University of British Columbia, Dept. of Zoology (Nov, **2019**). John M. Gosline Memorial Lecture: “*Neuromechanics of movement: stability and navigation in complex environments.*”

University of Montana, Dept. of Biology (Oct, **2019**). “*Maneuvering flight in birds: what visual clues and guidance laws operate for navigating cluttered environments?*”

Northeast Regional SICB (Univ. MA Lowell) Nov, **2017**. *Functional morphology and biomechanics as inspiration for legged robotics, flight navigation and musculoskeletal modeling.*

Applied Mechanics Colloquium Series, SEAS, Harvard University (Sept, **2017**). *Bioinspired flight: bird navigation through cluttered environments.*

Stanford University, Department of Biology, Hopkins Marine Station (June, **2017**). *Bird flight performance in an ecological context: linking lab studies to field studies of flight biomechanics and aerial maneuvering.*

Stanford University, Department of Mechanical Engineering (June, **2017**). *Avoiding obstacles during flight: bird navigation through cluttered environments.*

Brown University, Department of Ecology and Evolutionary Biology (March **2017**). *Avian flight navigation – maneuvering through cluttered environments.*

International Autumn School of Movement Science Humboldt-Universität, Berlin Germany (Oct, **2016**).
Invited Speaker: *Biomechanics of Mammalian and Avian Terrestrial Locomotion*

Keynote Speaker: Arizona Section: *American Physiological Society*, Phoenix AZ (Nov **2015**) *How do running animals achieve stability? The neuromechanical control of rapid locomotion.*

University of Oregon, Dept. of Human Physiology (April **2014**) *Neuromuscular and biomechanical studies of terrestrial and aerial locomotion: guiding the development of Hill-type muscle models and biorobotic design.*

University of Florida, Whitney Marine Laboratory (Mar **2014**) *Neuromuscular and biomechanical studies of terrestrial and aerial locomotion and their relevance to robotic design.*

Georgia Institute of Technology (Sept **2013**), Physics and Applied Physiology, *Neuromuscular and biomechanical studies of terrestrial and aerial locomotion: guiding the development of Hill-type muscle models and biorobotic design.*

Northwest American Society of Biomechanics Research Symposium (Moscow, ID June **2013**)
Neuromuscular and biomechanical studies of terrestrial and aerial locomotion: guiding the development of Hill-type muscle models and biorobotic design. [Keynote lecture]

Carnegie Mellon University, Robotics Institute (Nov **2012**), *Animal models for robotic design: neuromuscular and biomechanical studies of terrestrial and aerial locomotion.*

Harvard University (Festschrift to honor Farish A. Jenkins, Jr., June **2012**), *Postural effects on limb muscle*

mechanical advantage and its implications for mammalian locomotion.

University of British Columbia, Zoology Dept. (Mar **2012**), *Maneuvering flight in birds: how do birds turn and what guidance laws operate for navigating cluttered environments?*

Northeastern University, Bioengineering and Biology Action Club Seminar Series (Nov **2011**), *Assessing in vivo neuromuscular function: implications for control of muscle function across locomotor behaviors.*

M.I.T., Computer Science and Artificial Intelligence (Aug **2011**), *Navigational rules for path planning in a cluttered environment.*

Clemson University, Biology Dept. (November **2009**) *Exploring the neuromechanics of locomotion: how do muscles power and help to stabilize animal movement?*

Oregon State University, Biology Dept. (May **2009**) *Locomotor dynamics of muscle function: power output, economy and control.*

Virginia Institute of Technology (April **2009**) Kevin Granata Memorial Lecture, *Integrating in vivo muscle-tendon function with whole body & limb dynamics to understand limb design and neuromuscular control.*

Tufts University, Biology Dept. (November **2008**) *Locomotor dynamics of muscle function: power output, economy and control.*

University of Alberta, Edmonton, Department of Physiology (March **2007**). *Muscle dynamics during locomotion: Is there a proximo-distal gradient for work modulation versus force economy and control?*

Banff - Neuromechanics Conference on Motor Control (March **2007**). *Control of running mechanics: passive dynamics and active control for stability.*

Beijing University, Aeronautics and Aerospace Institute, Beijing China (Oct **2007**) *Muscle function underlying the aerodynamics of bird flight* (Plenary Lecture)

Beijing University, Aeronautics and Aerospace Institute, Beijing China (Oct **2007**) *Neuromuscular control and limb mechanics of stabilization during running* (Plenary Lecture)

Boston Dynamics Seminar (Waltham, MA December 2007). *Muscle dynamics and the neuromechanics of movement control and stability.*

Royal Veterinary College, (May, **2006**) *Muscle dynamics during locomotion: is there a proximo-distal gradient in function?*

Cornell University, IGERT-Dynamical Systems Colloquium Seminar (May, **2005**) *Muscle dynamics during locomotion: from active power modulation and force economy to passive dynamics*

Harvey Mudd College, Biology Department (March **2005**) *Dynamics of muscles and animal movement*

University of Portland, Biology Department (Nov **2004**) *Power vs economy: in vivo muscle function during flight and terrestrial locomotion*

University of Washington, Zoology Department (Nov **2004**) *Comparative aspects of in vivo muscle performance: design for power versus economy*

Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine (Sept., **2002**) *Evolutionary and Adaptive Features of Vertebrate Skeletal Design*

Department of Zoology, University of British Columbia (April, **2000**), Graduate Student Symposium
Keynote Speaker *In vivo dynamics of muscle function*

Organismic and Evolutionary Biology, University of Massachusetts, Amherst (March, **2000**), *Evaluating the dynamics of muscle function in terrestrial versus aerial locomotion*

Committee on Evolutionary Biology, University of Chicago (January, **2000**), *Muscle function underlying avian flight: implications for the evolution of flapping flight*

Dept. of Ecology and Evolutionary Biology, Brown University (October, **1999**), *Safety Factors in the Design of the Musculoskeletal System: Functional Tradeoffs and Optimization*

Dept. of EPO Biology, Univ. of Colorado, Boulder, CO (March **1999**), *Dynamics of Muscle Function In Vivo: muscle-tendon design in relation to mechanical power versus force economy and elastic energy savings*

Dept. of Biology, Univ. of North Carolina, Chapel Hill, NC (March **1999**), *Dynamics of Muscle Function In Vivo: comparing muscles used to generate mechanical power versus force economy and elastic energy savings*

Dept. of Biological Anthropology and Anatomy, Duke University, Durham, NC (February **1999**), *Scaling of limb mechanical advantage in mammalian terrestrial locomotion: biomechanical and physiological implications*

Dept. of Physiology, Univ. of Arizona (April, **1998**), *Evaluating muscle function under in vivo conditions: design for mechanical power output vs elastic energy storage.*

Depts. of Veterinary Medical Science & Biology, California St. Polytechnic Univ. (March, **1998**), *Evaluating muscle function under in vivo conditions: design for mechanical power output vs elastic energy storage.*

Dept. of Ecology and Evolution, Brown University (April, **1997**), *Scaling muscle mechanical advantage in mammals: implications for the energy cost of locomotion.*

Dept. of Organismic and Evolutionary Biology, Harvard University (Feb, **1997**), *Assessing muscle function in vivo: a comparison of muscle used for elastic energy storage versus mechanical power output.*

Concord Field Station, C. Richard Taylor Memorial Symposium (Nov, **1996**), *In vivo muscle mechanics.*

Department of Cell & Molecular Biology, Northwestern University Medical School, Lectures in the Life Sciences (Oct, **1995**), *Skeletal design and remodeling in relation to functional strain patterns*

Department of Orthopaedics, Royal Adelaide Hospital (June **1994**), *Cortical bone response to in vivo patterns of strain.*

Department of Physiology, University of Adelaide (June, **1994**), *Muscle mechanics in vivo: how are muscles used to power locomotion?*

Department of Biological Science, Flinders University (June, **1994**), *Muscle mechanics in vivo: how are muscles used to power locomotion?*

Department of Pathology, Institute of Medical & Veterinary Science, University of Adelaide (May, **1994**), *Bone remodeling in relation to functional strain patterns: how responsive is bone tissue to changes in mechanical loading?*

Department of Integrative Biology, The University of California, Berkeley (Feb, **1993**), *An in vivo assessment of the mechanical power output during different modes of flight in pigeons*

Department of Organismic and Evolutionary Biology, Harvard University (June, **1990**), *Bone modeling during growth and in relation to exercise*

Department of Biology, Northeastern University (December, **1989**), *Tradeoffs in the design for elastic energy recovery versus acceleration and safety factor*

Division of Biological Sciences, University of Montana (September **1989**) *Elastic energy recovery and jumping performance in the kangaroo rat*

Department of Biology, University of Calgary (February, **1989**), *Muscle function in terrestrial Locomotion*

Department of Biological Anthropology and Anatomy, Duke University (January, **1989**), *Stress similarity: mechanical constraints on the design of muscle and bone*

SYMPOSIA Presentations & PLENARY LECTURES:

Society for Integrative and Comparative Biology (Jan, **2022**) Phoenix, AZ. Invited Symposium Speaker: Causal Mechanisms of Interspecific Metabolic Scaling Patterns): *What can mammalian terrestrial biomechanics tell us about metabolic scaling patterns?*

HHMI Janelia 4D Cellular Physiology Planning Workshop (June 23 - 24, **2021**) *Mechanics in Physiological Systems: From Organelle to Organism*. Invited Speaker on *Biomechanics Across Scales*: “Neuromechanics: an integrative approach to movement & motor control”

American Society of Biomechanics (Aug, **2019**) Calgary, Alberta, Canada. Invited Symposium Keynote Address (*Comparative Biomechanics Symposium*): “Linking in vivo muscle function to whole body mechanics and movement”.

International Society of Biomechanics (Aug, **2019**) Calgary, Alberta, Canada. Invited Symposium Speaker (*In vivo musculoskeletal mechanics and properties*): “Linking in vivo muscle mechanics to the development and evaluation of muscle models”.

Neuromechanics Satellite Symposium (July, **2019**) Univ. of Calgary “Guinea fowl gastrocnemius force-length dynamics during obstacle negotiation: role of autogenic proprioception?” (J. Gordon, M. A. Daley and A. A. Biewener)

American Society of Biomechanics (Aug, **2017** – 41st Annual Meeting, Boulder, CO) *Biomechanics of*

Mammalian and Avian Terrestrial Locomotion: Insights into human biomechanics and biorobotic design.

EPSCoR Nebraska Research and Innovation Conference: Biomechanics Symposium, Omaha, NB (Oct, **2016**). Distinguished Invited Speaker: *Using animal studies of in vivo muscle function to validate Hill-type muscle models applied to evaluating the biomechanics of human movement.*

Biomechanics and Neural Control of Movement, Deer Creek St. Park, Sterling OH, (June, **2016**) Invited Symposium Speaker: *What has changed over the past 20 years with respect to assessing and understanding the biomechanics and neural control of movement?*

Society for Experimental Biology, Brighton, England (July, **2016**). Invited Speaker, Symposium: Short-range visual guidance in birds: *Avoiding obstacles during flight: bird navigation through cluttered environments.*

Company of Biologists – *Journal of Experimental Biology* Symposium “Muscle: Molecules to Motion” 21-25 March **2015** (Massa Marittima, Italy) *Locomotion as an Emergent Property of Muscle Contractile Dynamics.*

ONR MURI Program Review: UAV Flight Through Cluttered Environments, Arlington VA (April **2013**), *Pigeon head saccades and obstacle flight strategies for robust flight through artificial forests*

University of Idaho/Washington St. Univ. (May 31 **2013**) Northwest Biomechanics Symposium Keynote Lecture: *Neuromuscular and biomechanical studies of terrestrial and aerial locomotion: guiding the development of Hill-type muscle models and biorobotic design.*

American Society of Biomechanics (Brown University, Providence, RI) Invited Biorobotics Symposium Talk: *Biomechanics of goat and dog locomotion: bioinspiration for BigDog* (August **2010**) – declined due to personal circumstances.

American Physiological Society (Westminster, CO) *Invited Symposium Talk*: “Muscular control of avian flight” (July **2010**) & Symposium Co-Organizer: “*Off the beaten path: Integrative aspects of muscle function during diverse locomotor behaviors*” – declined due to personal circumstances.

Dynamic Walking Conference (M.I.T., Cambridge MA) *Invited Keynote Talk*: “Musculoskeletal morphology in relation to neural control of walking, running and hopping” (July **2010**) – declined due to personal circumstances.

Society for Experimental Biology (Vienna, Austria) *Invited Keynote Talk*: “Elastic Mechanisms in Animal Flight.” (July **2010**) – declined due to personal circumstances.

Mathematical Biosciences Institute (Ohio St. Univ.) *Biomechanics and Neural Control - Muscle, Limb, and Brain*. “Functional diversification within and between muscle synergists may simplify motor control.” (January **2008**)

Mathematical Biosciences Institute (Ohio St. Univ.) *Neuromechanics of Locomotion*. “Integrating in vivo muscle-tendon function with whole-body and limb mechanics to understand motor control strategies.” (April **2008**)

Symposium co-organizer (w/ A Wilson, RVC): *Biomechanics of terrestrial locomotion*, World Congress on Biomechanics - V, Munich, Germany (July **2006**)

Invited talk: A. A. Biewener, E. Yoo & M. P. McGuigan, "Is there a proximo-distal gradient of limb muscle function?"

Symposium co-organizer (w/ K. Nishikawa, NAU): *Biomechanics and Neuromuscular Control*, Society for Integrative and Comparative Biology, Orlando, FL (January **2006**)

Invited talk: A. A. Biewener & M. A. Daley, "Neuromuscular dynamics: passive versus active control of locomotion and stability"

Symposium co-organizer (w/ A Wilson, RVC): *Biomechanics of Unsteady Locomotion*, Society for Experimental Biology, Barcelona, Spain (July **2005**)

DARPA, BioDynamics Program Symposium on bio-inspired robotics design (Oct **2005**) Invited talk: A. A. Biewener, "Dynamics of locomotion over rocky and steeply graded terrain: experimental insights from goats and dogs"

California Institute of Technology, Bioengineering Symposium: *BIOMECHANICAL ADAPTATION AND BIOINSPIRED ENGINEERING* (March **2005**) "Muscle dynamics during locomotion: from active power modulation and force economy to passive dynamics"

Journal of Experimental Biology Symposia Series, Company of Biologists, Ascona, Switzerland, Sept. **2004**, *Scaling in Biology*, "Biomechanical Consequences of Scaling"

Sports Medicine & Biomechanics of Extracellular Matrix, Carlsberg Academy of Science, Copenhagen, Denmark, Aug **2004**, "Mechanical Loading of Tendons - Implications for Function"

VII International Congress on Vertebrate Morphology, Boca Raton FL, July. **2004**, *Integrating Approaches to the Study of Terrestrial Locomotion*, "Patterns of Mechanical Energy Change in Tetrapod Gait: Pendula, Springs and Work"

American Physiological Society, *The Power of Comparative Physiology*, Aug. **2002** Symposium "Mechanisms of *in vivo* muscle function that reduce energy expenditure or enhance performance"

Banff Skeletal Muscle Symposium, Aug. **2002**, *Skeletal Muscle*, "From Single Fibers to Whole Muscle: Evaluating In Vivo Muscle Function"

VI World Congress on Biomechanics, Calgary, Aug. **2002**, *Energetics and Mechanics of Locomotion*, "Variable Gears in Animal Locomotion: Effects of Speed, Gait and Size"

Plenary Lecture. V1 *International Congress on Vertebrate Morphology*, Jena, Germany (August, **2001**): *Future Directions for the Analysis of Musculoskeletal Design and Locomotor Performance*

The Wellcome Trust, Oct. **1999**, Highgate House, Northamptonshire, England, Conference on *Osteoporosis as a Failure of Bone's Adaptation to Functional Load Bearing*, "Functional strain as the determinant of bone architecture"

American Society of Biomechanics, Oct. **1999**, Pittsburgh PA, *A Tribute to Thomas A. McMahon*, "Scale effects in biology: implications for biomechanical and physiological function"

International Society of Biomechanics, Aug. **1999**, Calgary, Alberta, *Muscle Symposium I*, "Swimming vs. terrestrial gait: locomotor constraints associated with competing functional requirements"

Canmore Symposium on Skeletal Muscle, Aug. **1999**, Canmore, Alberta, "The dynamics of muscle function *in vivo*: power vs. economy of force generation"

American College of Sports Medicine, June, **1999**, Seattle, WA, Symposium: *Positives of Negatives and other Eccentric Matters*, "Tendon and muscle fiber roles in eccentric contractions: tradeoffs in the design for economy of gait versus control of movement"

Scanning Microscopy International, **1997** Annual Meeting, *Hard Tissue Structure Symposium*, "Trabecular Architecture in Relation to Mechanical Loading", A A Biewener, K Smith & N L Fazzalari

Society for Integrative Biology, **1996** Annual Meeting (Dec 27-30th) Symposium: *Muscle Properties and Organismal Function: Shifting Paradigms*, "Evaluating Muscle Function In Vivo: a Comparison of muscles used as springs vs muscles used to generate force"

Society for Physical Regulation in Biology & Medicine, **1996** Annual Meeting (Oct 9-11th), Chicago, IL Symposium: *Influence of Mechanical Forces on Vertebrate Evolution and Design*. Keynote Address: "Evolution of Musculoskeletal Design: locomotor strain patterns, skeletal safety factor and bone remodeling"

American Society of Biomechanics 19th Annual Meeting (Aug. 24-26, **1995**), Stanford University, *Symposium on Comparative Locomotion*, "Using animal studies to understand how muscles power locomotion"

ICCP International Conference on Comparative Physiology, Ascona, Switzerland (July 1-5, **1995**), *Optimization in Biological Design: controversies about symmorphosis*. "Optimization of Musculoskeletal Design: Does Symmorphosis Apply?"

International Congress on Vertebrate Morphology (31 July - 4 August **1994**), Symposium Organizer/Co-chair. *Design of Musculoskeletal Systems*

NIH Workshop on *Aging & Bone Quality*, Bethesda, MD (September 4&5th, **1992**), organized by A. M. Parfitt and R. P. Heaney, "Safety Factors in Bone Strength"

American Association of Anatomists, Chicago (April 23, **1991**), *Scaling Symposium*, "Effects of Size on Musculoskeletal Structure and Function"

NASA Symposium: *The Influence of Gravity and Activity on Muscle and Bone* (January 29-30th, **1990**), Ames Research Division. "Musculoskeletal design in relation to size".

North American Engineering Foundation Conference, "Scaling body support in mammals: limb posture and muscle mechanics", July, **1989**. Missouri.

American Society of Zoologists (December, **1988**), in *Concepts of Efficiency in Biological Systems*, "Efficiency and Optimization of Skeletal Support Systems"

Sun Valley Hard Tissue Workshop, (August, **1987**), The University of Utah, "Dynamic strain equilibrium and control for bending"

RESEARCH PUBLICATIONS:**(ORIGINAL ARTICLES)**

(Total: 189)

- 2022** Harrison, J.F., A.A. Biewener, J.R. Bernhardt, J.R. Burger, J.H. Brown, Z.N. Coto, M.E. Duell, M. Lynch, E.R. Moffett, T. Norin, A.K. Pettersen, F.A. Smith, U. Somjee, J.F.A. Traniello, and T.M. Williams (2022). White paper: An Integrated Perspective on the Causes of Hypometric Metabolic Scaling in Animals. *Int. Comp. Biol.* 62(5): 1395-1418. <https://doi.org/10.1093/icb/icac136>
- Biewener, A. A. (2022). Primer: Biomechanics of avian flight. *Current Biology* 32, R1110–1114. <https://doi.org/10.1016/j.cub.2022.06.079>
- Biewener, A. A. (2022) Dispatch: Physiology – Woodpecker skulls are not shock absorbers. *Current Biology* 32:R767-769. <https://doi.org/10.1016/j.cub.2022.06.037>
- Biewener, A. A., R. N. Bomphrey, M. A. Daley and A. J. Isjpeert (2022). Stability and manoeuvrability in animal movement: lessons from biology, modelling, and robotics. (Theme Issue) *Proc. Royal Society, B*. 289: 20212492. (p. 1-5) <https://doi.org/10.1098/rspb.2021.2492>
- 2021** Tijds, C., N. Konow and A. A. Biewener (2021). Effect of muscle stimulation intensity on the heterogeneous function of compartments within an architecturally complex muscle. *J. appl. Physiol.* 130:941-951. doi:10.1152/jappphysiol.00514.2020.
- Lai, Adrian K.M., T.J.M. Dick, N.A.T. Brown, A.A. Biewener and J.M. Wakeling (2021). Lower-limb muscle function is influenced by changing mechanical demands in cycling. *The Journal of Experimental Biology*, jeb.228221. doi:10.1242/jeb.228221
- Lai, Adrian K.M., T.J.M. Dick, A.A. Biewener and J.M. Wakeling (2021) Task-dependent recruitment across ankle extensor muscles and between mechanical demands is driven by the metabolic cost of muscle contraction. *J R Soc Interface* 18:20200765 DOI: [10.1098/rsif.2020.0765](https://doi.org/10.1098/rsif.2020.0765)
- Wakeling, J. M., C. Tijds, N. Konow and A. A. Biewener (2021). Modeling muscle function using experimentally determined subject-specific muscle properties. *J. Biomechanics*. 117: 1-9. doi.org/10.1016/j.jbiomech.2021.110242.
- 2020** Gordon, J. C., N. C. Holt, A. A. Biewener and M. A. Daley (2020). Tuning of feedforward control enables stable muscle force-length dynamics after loss of autogenic proprioceptive feedback. *eLife*. 2020;9:e53908. doi:10.7554/eLife.53908.
- Ravi, S., R. Noda, S. Gagliardi, D. Kolomenskiy, S. Combes, H. Liu, A. A. Biewener, and N. Konow (2020). Modulation of flight muscle recruitment and wing rotation enables hummingbirds to mitigate aerial roll perturbations. *Current Biology* 30(2):187-195.e4. doi:10.1016/j.cub.2019.11.025
- Konow, N., A. Collias and A. A. Biewener (2020). Skeletal muscle shape changes in relation to varying force requirements across locomotor conditions. *Frontiers Physiology* 11:143. doi:[10.3389/fphys.2020.00143](https://doi.org/10.3389/fphys.2020.00143)

- Fahn-Lai, P., A. A. Biewener, and S. E. Pierce (2020). Broad similarities in shoulder muscle architecture and organization across two amniotes: implications for reconstructing non-mammalian synapsids. *PeerJ* 8: e8556. doi.org/[10.7717/peerj.8556](https://doi.org/10.7717/peerj.8556).
- Veiga, Gabriela N., A. A. Biewener, A. Fuller, T. M. F. N. van de Ven, C. P. McGowan, W. Panaino, and E. P. Snelling (2020). Functional morphology of the ankle extensor muscle-tendon units in the springhare *Pedetes capensis* shows convergent evolution with macropods for bipedal hopping locomotion. *J. Anatomy* 237(3): 568-578. doi.org/10.1111/joa.13214.
- Taylor-Burt, K. R. and A. A. Biewener (2020). Aquatic and terrestrial takeoffs require different hindlimb kinematics and muscle function in mallard ducks. *J. exp. Biology* 223(16):1-13. (doi.org/10.1242/jeb.223743). Journal Cover: 
- Taylor-Burt, K. R., N. Konow and A. A. Biewener (2020). Post-activation muscle potentiation and its relevance to cyclical behaviors. *Biology Letters* 16(6): 1-6. doi.org/10.1098/rsbl.2020.0255.
- Ross, S.A., B. Rimkus, N. Konow, A.A. Biewener and J.M. Wakeling (2020). Added mass in rat plantaris muscle causes a reduction in mechanical work. *J. exp. Biology* 223(19):1-11. doi.org/10.1242/jeb.224410.
- 2019** Lai, A., A. A. Biewener and J. M. Wakeling (2019). Muscle-specific indices to characterise the functional behaviour of human lower limb muscles during locomotion. *J. Biomechanics*. 89: 134-138.
- Clites, T. R., A. S. Arnold, N. M. Singh, E. Kline, H. Chen, C. Tugman, B. Billadeau, A. A. Biewener and H. M. Herr (2019). Goats decrease hindlimb stiffness when walking over compliant surfaces. *J. exp. Biol.* 222:1-9. doi.org/10.1242/jeb.198325.
- McHorse, B. K., A. A. Biewener and S. E. Pierce (2019). The evolution of a single toe in horses: causes, consequences, and the way forward. *Int. Comp. Biol.* 59(3): 638-655. doi.org/10.1093/icb/icz050.
- Biewener, A. A. (2019). Getting to grips with how birds land stably on complex surfaces. News & Views. *Nature* 574: 180-181. doi: 10.1038/d41586-019-02959-w.
- Eng, C. M., C. Tijs, N. Konow, N. C. Holt and A. A. Biewener (2019). In vivo force-length and activation dynamics of two distal rat hindlimb muscles in relation to gait and grade. *J. exp. Biol.* 222: 1-13. doi:10.1242/jeb.205559
- 2018** Lai, A., A. S. Arnold, A. A. Biewener, T. J.M. Dick and J. M. Wakeling (2018). Does a two-element muscle model offer advantages when estimating ankle plantar flexor forces during human cycling? *J. Biomechanics* 68: 6-13. (doi.org/10.1016/j.jbiomech.2017.12.018)
- Lai, P. H., A. A. Biewener and S. E. Pierce (2018). Three-dimensional mobility and muscle attachments in the pectoral limb of the Triassic cynodont *Massetognathus pascuali* (Romer, 1967). *J. Anatomy* 232: 383-406 (doi: 10.1111/joa.12766).

- Biewener, A. A. (2018). Evolutionary race as predators hunt prey. News & Views. *Nature* 554: 176-178. doi: 10.1038/d41586-018-01278-w.
- Ahn, A. N., N. Konow, C. Tijs and A. A. Biewener (2018). Different segments within vertebrate muscles can operate on different regions of their force-length relationships. *Int. Comp. Biol.* 58: 219-231. doi.org/[10.1093/icb/icy040](https://doi.org/10.1093/icb/icy040)
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