

Thomas J. Roberts

Curriculum Vitae

1. Name and position

Thomas Jay Roberts
Associate Professor
Ecology and Evolutionary Biology, Brown University

2. Education

- 1995-1998 Northeastern University
Postdoctoral Fellow
Postdoctoral Advisor: Dr. Richard Marsh
- 1990-1995 Harvard University
Degrees received: A.M., Ph.D. in Biology. Dissertation title: Running economically: form, gait and muscle mechanics
Doctoral thesis advisor: Dr. C. Richard Taylor
- 1988 University of Chicago
Degree received: B.A. in Biology, with Honors

3. Professional appointments

- 2008-present Associate Professor, Ecology and Evolutionary Biology, Brown University
- 2004- 2008 Assistant Professor, Ecology and Evolutionary Biology, Brown University
- 1998-2004 Assistant Professor, Department of Zoology, Oregon State University
- 1995-1998 Research Fellow, Department of Biology, Northeastern University
- 1994-1995 Research Assistant, Department of Organismic and Evolutionary Biology, Harvard University
- 1990-1994 Teaching Fellow, Harvard University
- 1989-1990 Research Assistant, Department of Organismic and Evolutionary Biology, Harvard University
- 1988 Teaching Assistant, Department of Ecology and Evolution, University of Chicago.

4. Completed publications

a. Refereed Journal Articles

Weber, J.-M., Roberts, T. J. and C. R. Taylor. (1993). Mismatch between lipid mobilization and oxidation: glycerol kinetics in running African goats. *Am. J. Phys.* 264, R797-R803.

Taylor, C. R., Weibel, E. R., Weber, J.-M., Vock, R., Hoppeler, H., Roberts, T. J. and G. Brichon. (1996). Design of the oxygen and substrate pathways. I. Model and strategy to test symmorphosis in a network structure. *J. Exp. Biol.* 199, 1643-1649.

- Weber, J.-M., Roberts, T. J., Vock, R., Weibel, E. R. and C. R. Taylor. (1996). Design of the oxygen and substrate pathways. III. Partitioning energy provision from carbohydrates. *J. Exp. Biol.* 199, 1659-1666.
- Weibel, E. R., Taylor, C. R., Weber, J.-M., Vock, R., Roberts, T. J. and H. Hoppeler. (1996). Design of the oxygen and substrate pathways. VII. Different structural limits for oxygen and substrate supply to muscle mitochondria. *J. Exp. Biol.* 199, 1699-1709.
- Roberts, T. J., Weber, J.-M., Hoppeler, H., Weibel, E. R. and C. R. Taylor. (1996). Design of the oxygen and substrate pathways. II. Defining the upper limits of carbohydrate and fat oxidation. *J. Exp. Biol.* 199, 1651-1658.
- Langman, V. A., Rowe, M., Forthman, D., Whitton, B., Langman, N., Roberts, T. J., Huston, K., Boling, C. and D. Maloney. (1996). Thermal Assessment of Zoological Exhibits I: Sea Lion Enclosure at the Audobon Zoo. *Zoo Biology* 15, 403-411.
- Roberts, T. J., Marsh, R. L., Weyand, P. G. and C. R. Taylor. (1997). Muscular force in running turkeys: the economy of minimizing work. *Science* 275, 1113-1115.
- Roberts, T. J. (1998). Moving on land: optimizing for minimum cost. In *Diversity in biological design: Symmorphosis - fact or fancy* (ed. E. R. Weibel, C. R. Taylor and L. C. Bolis), pp. 114-120. Cambridge: Cambridge University Press.
- Roberts, T. J., Kram, R., Weyand, P. G. and C. R. Taylor. (1998). Energetics of bipedal running I. Metabolic cost of generating force. *J. Exp. Biol.* 201, 2745-51.
- Roberts, T. J., Chen, M. S. and C. R. Taylor. (1998). Energetics of bipedal running II. Limb design and running mechanics. *J. Exp. Biol.* 201, 2753-62.
- Biewener, A. A. and T. J. Roberts. (2000). Muscle and tendon contributions to force, work, and elastic energy savings: a comparative perspective. *Exerc. Sport Sci. Rev* 28(3), 99-107.
- Roberts, T. J. (2001) Muscle force and stress during running in dogs and wild turkeys. *Bull. Mus. Comp. Zool.* 156(1), 283-295.
- Roberts, T. J. and Scales, J. A. (2002). Mechanical power output during running accelerations in wild turkeys. *J. Exp. Biol.* 205, 1485-94.
- Roberts, T. J. (2002). The integrated function of muscles and tendons during locomotion. *Comp. Biochem. Physiol. A*: 133, 1087-1099.
- Griffin TM, Roberts TJ, and Kram R. (2003) Metabolic cost of generating muscular force in human walking: insights from load-carrying and speed experiments. *J. Appl. Physiol.* 95: 172-183.
- Roberts TJ and Marsh RL. (2003) Probing the limits to muscle-powered accelerations: lessons from jumping bullfrogs. *J. Exp. Biol.* 206: 2567-2580.

Gabalton, A. M., Nelson, F. E. and Roberts, T. J. (2004). Mechanical function of two ankle extensors in wild turkeys: shifts from energy production to energy absorption during incline versus decline running. *J Exp Biol* 207, 2277-88.

Nelson, F. E., Gabalton, A. M. and Roberts, T. J. (2004). Force-velocity properties of two avian hindlimb muscles. *Comp Biochem Physiol A Mol Integr Physiol* 137, 711-21.

Biewener, A. A., Farley, C. T., Roberts, T. J. and Temaner, M. (2004). Muscle mechanical advantage of human walking and running: implications for energy cost. *J Appl Physiol* 97, 2266-74.

Roberts, T. J. and Scales, J. A. (2004). Adjusting muscle function to demand: joint work during acceleration in wild turkeys. *J Exp Biol* 207, 4165-74.

Roberts, T. J. and Belliveau, R. (2005) Sources of mechanical power for uphill running in humans. *J. Exp. Biol.* 208, 1963-70.

Roberts TJ, Higginson BK, Nelson FE (2007) Muscle strain is modulated more with running slope than speed in wild turkey knee and hip extensors. *J. Exp. Biol.* 210, 2510-7.

Gabalton, A. M., Nelson, F. E. and Roberts, T. J. (2008). Relative shortening velocity in locomotor muscles: turkey ankle extensors operate at low V/V_{max} . *Am. J. Physiol.* 294 , R200-210.

Azizi, E., Brainerd, E. L. and Roberts, T. J. (2008). Variable gearing in pennate muscles. *Proc. Natl. Acad. Sci. U S A.* 105 (5), 1745-1750.

Nelson, F. E. and Roberts, T. J. (2008). Task-dependent force sharing between muscle synergists during locomotion in turkeys. *J. Exp. Biol.* 211, 1211-20.

Roberts, T. J. and Gabalton, A. M. (2008). Interpreting muscle function from EMG: lessons learned from direct measurements of muscle force. *Int. Comp. Biol.* 48, 312-320.

b. Non-refereed Journal Articles

Roberts, T. (2005). A step forward for locomotor mechanics. *J. Exp. Biol.* 208, 4191-2.

e. Abstracts

Abbott, E. and T.J. Roberts, 2009. Elastic mechanisms as a determinant of anuran jumping performance: do toads bounce? Society for Integrative and Comparative Biology, Boston, MA.

Azizi, E. and T.J. Roberts, 2009. Mechanical behavior of aponeuroses. Society for Integrative and Comparative Biology, Boston, MA.

- Roberts, T.J. and E. Azizi, 2009. The series elastic shock absorber: tendon elasticity reduces peak muscle forces during active lengthening. Society for Integrative and Comparative Biology, Boston, MA.
- Azizi, E. and T.J. Roberts, 2009. Muscle performance during frog jumping: influence of series elasticity on muscle length-tension behavior. Society for Integrative and Comparative Biology, Boston, MA.
- Sawicki GS, Azizi E, Roberts TJ, 2008. Muscle activation timing influences muscle-tendon mechanical performance during cyclic contractions. North American Congress on Biomechanics, August 5-9, Ann Arbor, Michigan.
- Roberts, T.J., 2008. Interpreting muscle function from EMG: lessons learned from direct measurements of muscle force. Society for Integrative and Comparative Biology, San Antonio, TX.
- Hsieh, S.T. and T.J. Roberts, 2008. Do hindlimb joints serve multiple functions during jumping in the Cuban tree frog? Society for Integrative and Comparative Biology, San Antonio, TX.
- Azizi, E. and T.J. Roberts, 2008. Three-dimensional strain patterns in aponeuroses. Society for Integrative and Comparative Biology, San Antonio, TX.
- Roberts, T.J., and B.K. Higginson, 2007. The versatile mechanical function of two proximal hindlimb muscles in running turkeys. Society for Integrative and Comparative Biology, Phoenix, AZ.
- Azizi, M. and T. J. Roberts, 2007. *Variable gearing in pinnate muscles*. Society for Integrative and Comparative Biology, Phoenix, AZ.
- Azizi, M. and T. J. Roberts, 2006. *Variable gearing in pinnate muscles*. American Physiological Society meeting, Va. Beach, Va.
- Roberts, T.J., 2006. *Muscle Mechanical Function and the Energy Cost of Running - When does Work Matter?* American College of Sports Medicine Annual Meeting. Denver, CO.
- Roberts, T.J., 2006. *Integrated muscle-tendon function during running accelerations*. World Congress of Biomechanics, Munich, Germany.
- Roberts, T. J. and A. M. Gabaldon, 2006. *Does rate of force production increase with running speed in individual muscles?* Society for Integrative and Comparative Biology, Orlando, FL.
- Roberts, T. J. 2005. Biomechanics of acceleration and muscle performance in terrestrial acceleration. Society for Experimental Biology, Barcelona, Spain.
- Gabaldón, A.M., F.E. Nelson, and T.J. Roberts 2004. Force-velocity characteristics of ankle extensor muscles in wild turkeys during running and *in vivo*. *Society for Integrative and Comparative Biology*, New Orleans, LA.
- Gabaldón, A.M., F.E. Nelson, and T.J. Roberts 2003. Effect of running speed on the mechanical work output of two ankle extensor muscles in wild turkeys. *Experimental Biology*, San Diego, CA.

- Roberts, T. J. 2002. Mechanical power production for acceleration: the challenges of being a biped. *World Congress of Biomechanics*, Calgary CA.
- Roberts, T.J. 2002. The integrated function of muscles and tendons during locomotion. *Society for Integrative and Comparative Biology*, Anaheim, CA.
- Roberts T.J. and R. A. Belliveau 2002. The source of power for uphill running. *Experimental Biology*, New Orleans, LA.
- Gabaldon, A. M. and T. J. Roberts. 2002. Diverse mechanical functions in a single muscle: How muscles change function for different locomotor demands. *American Physiological Society*, San Diego, CA.
- Llewellyn, M. A.. and T. J. Roberts. 2002. Ground reaction forces in accelerating dogs. *Experimental Biology*, New Orleans, LA.
- Nelson, F. E., Gabaldon, A. M., and T. J. Roberts. 2002. Force-velocity properties of an avian muscle. *Society for Integrative and Comparative Biology*, Anaheim, CA.
- Gabaldon, A. M., Nelson, F. E., and T. J. Roberts. 2002. Gastrocnemius muscle mechanics in turkeys during uphill and downhill running. *Society for Integrative and Comparative Biology*, Anaheim, CA.
- Harty, T. L. and T. J. Roberts. 2002. Mighty mice: Amazing jumping power from the pacific jumping mouse. *Society for Integrative and Comparative Biology*, Anaheim, CA.
- Llewellyn, M. A. 2002. The work of acceleration in running dogs. *Society for Integrative and Comparative Biology*, Anaheim, CA.
- Roberts, T.J. and J. A. Scales. 2001. The source of power for acceleration in turkeys. *Society for Integrative and Comparative Biology*, Chicago, IL.
- Roberts, T. J. 2000. Muscle forces in running dogs and turkeys: testing the similar stress hypothesis. *American Physiological Society*, Portland, Maine.
- Roberts, T.J. and J. A. Scales. 2000. Power development during acceleration in wild turkeys. *Society for Experimental Biology*, Exeter, U.K.
- Roberts, T.J. and H.A. Humphries. 1999. Hind limb forces during acceleration in wild turkeys. *American Zoologist*, 39(5): 65A.
- Roberts, T. J., Marsh, R. L. and C. R. Taylor. 1997. Force development in passive muscle during running. *Experimental Biology*, San Francisco, CA.
- Roberts, T. J. and R. L. Marsh. 1997. Elastic energy storage in jumping frogs. *American Zoologist*, 37(5): 174A.
- Roberts, T. J., 1996. From whole animals to muscle fibers; a look inside the black box of locomotor energetics. Presented at *A life in comparative physiology: a tribute to the diverse interests and influences of C. R. Taylor*, Harvard University, MA.
- Roberts, T.J., R.L. Marsh, and C.R. Taylor. 1996. Running economically: elastic energy storage in tendon and muscle. *Society for Experimental Biology*, Lancaster, U. K.

Roberts, T.J., R.L. Marsh, P.G. Weyand and C.R. Taylor. 1995. Muscle performance during running: the price of power. *American Zoologist*, 35(5): 140A.

Roberts, T.J. 1995. Moving on land: optimizing for minimum cost. *12th International Conference on Comparative Physiology*, Ascona, Switzerland.

Roberts, T. J., R.A. Belliveau, and C. R. Taylor. 1994. Does uphill running require high muscle forces? *American Zoologist* 34(5): 46A.

Roberts, T. J., R. L. Marsh, C. I. Buchanan, P. G. Weyand, and C. R. Taylor. 1994. The work of running: do tendons pull their weight? *The Physiologist* 37(5): 54A.

Roberts, T., S. Shulman, R. Belliveau, M. Chen and C. R. Taylor. 1993. Energetics of locomotion: testing the force hypothesis. *Proc. of the XXXII Congress of the IUPS*, Glasgow, Scotland, 284.21/P.

Roberts, T. J., J.-M. Weber and C. R. Taylor. 1990. Does fuel preference depend on aerobic capacity? Fat and carbohydrate oxidation in running coyotes, dogs and goats. *The Physiologist* 33(4):110A.

f. Invited lectures

- 1995 12th International Conference on Comparative Physiology, Ascona, Switzerland.
- 1996 Northeastern University Department of Biology
University of Arizona Department of Ecology and Evolutionary Biology
- 1997 Brown University, Department of Ecology and Evolutionary Biology
- 1998 Massachusetts Institute of Technology, Leg Lab
- 1999 California State Polytechnic University Pomona, Equine Research Center
University of Chicago, Department of Organismal Biology and Anatomy
- 2000 University of California, Berkeley, Integrative Biology Department
University of California, Berkeley, Biomechanics Seminar Group
Society for Experimental Biology, Exeter, U.K.
- 2002 Society for Integrative and Comparative Biology. Anaheim, CA.
American Physiological Society, San Diego, CA.
IV World Congress of Biomechanics, Calgary, AB.
- 2004 University of Colorado, Boulder
University of Portland
- 2005 Society for Experimental Biology, Barcelona, Spain.
- 2006 Georgia Tech University, Atlanta
Rhode Island College, Providence
World Congress of Biomechanics, Munich, Germany.
- 2007 Harvard University, Concord Field Station
MIT Biomechatronics Group
University of Rhode Island, Biology Department

5. Research Grants

a. Current grants

- 2006-2009 W. M. Keck Foundation, Phase II Proposal, *A proposal to design and build a dynamic 3-D Skeletal imaging system*, \$1,800,00. (One of 7 co-investigators. PI: E. Brainerd)
- 2006-2009 National Science Foundation, *Integrated muscle-tendon function in frog jumping* (Principal Investigator). \$385,000.

2008-2012 National Institutes of Health, *Elastic mechanisms in locomotion* (Principle Investigator). \$950,137.

Grants to postdoctoral Trainees

2008-2011 Influence of tendon elasticity on muscle-tendon contractile element mechanics. NIH NRSA to G. Sawicki, T.J. Roberts sponsor. \$132,000.

2007-2010 Mechanical role of titin in limiting eccentric muscle damage. NIH NRSA to E. Azizi, T.J. Roberts sponsor. \$132,000.

b. Completed Grants

2000-2005 National Institutes of Health, *Dynamics of muscle force production during running* (Principle Investigator). \$557,502.

1999-2000 Medical Research Foundation of Oregon, *Influence of muscle force-velocity properties on running mechanics* (Principal Investigator). \$24,575.

2000-2003 GAANN training grant, (Dept. of Education) *Analysis of Complex Behaviors* (One of 9 core faculty. P.I.: S. Arnold). \$304,500.

1998 National Science Foundation Postdoctoral Fellowship in Biosciences Related to the Environment (declined).

1995-1998 Individual National Research Service Award, National Institutes of Health Stipend and research allowance for three years, \$78,000.

1990-1993 National Science Foundation Graduate Fellowship Stipend for three years, \$51,000.

c. Proposals submitted

National Institutes of Health, *Mechanical function of muscle during movement* (Co-P.I. P.I.: R. L. Marsh) \$203,665 subcontract to Brown. Submitted March, 2007.

6. Service

a. Service to the University

Member, Institutional Animal Care and Use Committee, 2008-present

Member, Medical Committee on Academic Standing, 2008

Panel participant, Sheridan Center "Preparing for Your First Year as a Faculty Member"

EEB space committee, 2004-2007

EEB graduate admissions committee, 2006

University Animal Users Committee, 2007

Concentration Advisor, Biology, 2007-present

b. To the profession

Judge, Scholander Award Competition, American Physiological Society, 2002

Awards Committee, American Society of Biomechanics, 2004

NSF panel service

Proposal reviewer for: National Science Foundation, National Institutes of Health
Murdoch Charitable Trust, Natural Sciences and Engineering Research Council of
Canada, Biotechnology and Biological Sciences Research Council, UK

Editorial reviewer for the journals: Science, Nature, Proceedings of the Royal Society,
London, Proceedings of the National Academy of Sciences, Evolution, Journal of
Theoretical Biology, American Zoologist, American Journal of Physical Anthropology,
American Journal of Physiology, Comparative Biochemistry and Physiology, European
Journal of Applied Physiology, Exercise and Sports Science Reviews, Journal of
Biomechanics, Journal of Experimental Biology, Journal of Applied Physiology,
Journal of Morphology, Journal of Physiology, London, Physiological Zoology,
Canadian Journal of Physiology and Pharmacology, Paleobiology, Anatomical Record,
Cells, Tissues, Organs

c. To the community

Speaker for Visual Cascade of Science, OSU, April 1999 and April 2000.

Coordinator for High-School visits to Anatomy and Physiology Labs, Oregon State
University (approx. 6 per year).

Hosted visit to Brown human anatomy laboratory for Bristol Community College, 2006,
2007

Guest speaker, Hope High School and host for an Hope High teacher research project
Disseminated research to popular press via stories in the BBC, New York Times, CBS
Evening News and others

8. Academic Honors, Fellowships and Professional Memberships

NSF Graduate Research Fellowship, 1990

Chapman Fellowship, Harvard University

NIH Postdoctoral Fellowship, 1995

NSF Postdoctoral Fellowship, 1998 (declined)

Brown Medical School Dean's Teaching Excellence Award, 2004, 2005, and 2006.

Member: American Society of Biomechanics, Society for Integrative and Comparative
Biology, Society for Experimental Biology, American Physiological Society

9. Teaching

INSTRUCTIONAL SUMMARY, BROWN UNIVERSITY:

Term	Course number	Course Name	Enroll-ment	Evaluation (score out of 5)
F 2004	Bio181	Human Morphology (co-taught with S. Gatesy, D. Ritter)	65	4.58
F 2005	Bio 181	Human Morphology(co-taught with E. Brainerd, D. Ritter)	68	4.68
F 2006	MD2010	Human Anatomy, (co-taught with E. Brainerd, S. Gatesy, D. Ritter)	94	4.82
F 2007	MD2011	Human Anatomy, (co-taught with E. Brainerd, S. Gatesy, D. Ritter)	94	
S 2008	BIOL 2440	EEB Grad Seminar -Evolutionary and Ecological Physiology, (co-taught with J. Schmitt)	15	

Guest lectures:

Bio 19, Adaptation to the Environment, 2004
Resident Education Series, Brown Orthopedics, 2004
Bio 19, Adaptation to the Environment, 2006
Bio 180, Animal Locomotion, 2007
Bio 118, Environmental Physiology, 2007
Bio 116, Exercise Physiology, 2007

Undergraduate Research

I have supervised seven undergraduate researchers in my lab at Brown. On average one or two of these students have been enrolled in Bio 195/196. Three of these students have spent a summer doing research in my lab, and one is currently completing a senior thesis.

I supervised approximately 10 undergraduate research students at Oregon State University. Several of these students are now in Ph.D. programs in biology.

Graduate Students

Frank Nelson, Ph.D. 2006, Oregon State University. Current position: postdoctoral fellow, Leeds University, U.K.
Jacquelyn Parente, M.A. 2007, Bioengineering, Brown U.
Henry Astley, current Ph.D student.

I have served or am currently serving on graduate committees of more than 15 students, at Brown and other universities (Johns Hopkins, Harvard, U. Colorado).

Postdoctoral associates

Dr. Annette Gabaldon, 2000-2004. Current position: Assistant Professor, Colorado State University
Dr. S. Tonia Hsieh, 2006-2007. Current position: Assistant Professor, U. Florida.
Dr. Emanuel Azizi (current)
Dr. Gregory Sawicki (current)