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Current Positions

- *Associate Professor** **starting 08/15/2017*
Georgia Institute of Technology, Dept. of Mechanical Engineering^{2/3} and School of Biological Sciences,^{1/3} Atlanta, GA.
- Associate Professor and University Faculty Scholar '13** *08/15/2015 - Present*
North Carolina State University and University of North Carolina at Chapel Hill, Joint Dept. of Biomedical Engineering, Raleigh, NC.
- Associate Professor and University Faculty Scholar '13** *08/15/2015 - Present*
North Carolina State University and University of North Carolina at Chapel Hill, Joint Dept. of Biomedical Engineering, Raleigh, NC.
- Associate Director, Rehabilitation Engineering Core** *08/15/2015 - Present*
North Carolina State University and University of North Carolina at Chapel Hill, Joint Dept. of Biomedical Engineering, Raleigh, NC.
- Director and Founder** *07/2010 - Present*
Human Physiology of Wearable Robotics (PoWeR) Laboratory, North Carolina State University, Joint Dept. of Biomedical Engineering, Raleigh, NC.
- Adjunct Associate Professor** *01/2010 - Present*
University of North Carolina at Chapel Hill, School of Medicine, Dept. of Allied Health Sciences, Chapel Hill, NC.
- Associate Faculty Member** *03/2010 - Present*
North Carolina State University, Dept. of Mechanical and Aerospace Engineering, Raleigh, NC.

Past Positions

- Visiting Sabbatical Scholar** *01/2016 - 07/2016*
Georgia Institute of Technology, School of Applied Physiology, Atlanta, GA.
- Assistant Professor** *08/2009 - 08/2015*
North Carolina State University and University of North Carolina at Chapel Hill, Joint Dept. of Biomedical Engineering, Raleigh, NC.
- Research Engineer** *05/1999 - 08/1999*
The Hospital for Special Surgery, New York, NY.

Education/Training

- Post-Doc**, Integrative Biology- 10/2007 - 7/2009
Brown University, Dept. of Ecology and Evolutionary Biology, The Roberts Lab, Providence, RI.
*NIH Sponsored Trainee (F32 - Kirschstein)
- Ph.D.**, Neuromechanics^{1,2}- 08/2002 - 09/2007
University of Michigan-Ann Arbor, Div. of Kinesiology¹ and Dept. of Mechanical Engineering², Ann Arbor, MI.
*Dissertation Title: Mechanics and energetics of walking with powered ankle exoskeletons
- Graduate Certificate**, Complex Systems- 08/2003 - 12/2006
University of Michigan-Ann Arbor, Center for the Study of Complex Systems, Ann Arbor, MI.
- Graduate Summer Fellow**, Complex Systems - 06/2004
Santa Fe Institute, Santa Fe, NM.
- M.S.**, Mechanical and Aeronautical Engineering - 09/1999 - 06/2001
University of California at Davis, School of Mechanical and Aeronautical Engineering, Davis, CA.
- B.S.** in Mechanical Engineering - 08/1995 - 05/1999
Cornell University, Sibley School of Mechanical Engineering, Ithaca, NY
*Recognition in Biological Engineering (Bio-Option Program)
*Concentration in Dynamic Systems

Journal Papers (Peer-Reviewed)

- *39. Robertson BD, Vadakkeveedu S, **Sawicki GS**, "A benchtop biorobotic platform for in vitro observation of muscle-tendon dynamics with parallel mechanical assistance from an elastic exoskeleton". *J Biomech.* Mar 21. (2017).
*This article was selected as the 2016 American Society of Biomechanics Journal of Biomechanics Award winner.
38. Rosario MV, Sutton GP, Patek SN, **Sawicki GS**, "Muscle-spring dynamics in time-limited, elastic movements". *Proc Biol Sci.* Sep 14; 283(1838) (2016).
37. Danos N, Holt N, **Sawicki GS**, Azizi E, "Modeling age-related changes in muscle tendon dynamics during cyclical contractions in the rat gastrocnemius muscle". *J Appl Physiol (1985)*. Oct 1; 124(4): 1004-1012 Epub Aug 4 (2016).
36. Takahashi KZ, Gross MT, van Werkhoven H, Piazza SJ, **Sawicki GS**, "Adding stiffness to the foot modulates soleus force-velocity behaviour during human walking". *Nat Sci Rep.* Jul 15; 6:29870 (2016).
35. **Sawicki GS**, Khan N, "A simple model to estimate plantarflexor muscle-tendon dynamics during walking with elastic ankle exoskeletons". *IEEE Trans Biomed Eng.* May; 63(5):914-923. Epub 2015 Oct 15, (2016).
*Invited submission to special issue.
34. Huang H, Crouch DL, Liu M, **Sawicki GS**, Wang D, "A cyber expert system for auto-tuning powered prosthesis impedance control parameters". *Ann Biomed Eng.* May; 44(5): 1613-24. Epub 2015 Sep 25. (2016).

33. **Sawicki GS**, Sheppard P, Roberts TJ, "Power amplification in an isolated muscle-tendon unit is load dependent". *J Exp Biol*. Nov; 218(Pt 22):3700-9. (2015).
32. Robertson BD, **Sawicki GS**, "Unconstrained muscle-tendon workloops indicate resonance tuning as a mechanism for elastic limb behavior during terrestrial locomotion". *Proc Natl Acad Sci U S A*. Oct 27; 112(43):E5891-8. (2015).
31. **Sawicki GS**, Robertson BD, Azizi E, Roberts TJ, "Timing matters: Tuning the mechanics of a muscle-tendon unit by adjusting simulation phase during cyclic contractions". *J Exp Biol*. Oct; 218 (Pt 19):3150-9. (2015).
30. Collins SH, Wiggan MB, **Sawicki GS**, "Reducing the energy cost of human walking using an unpowered exoskeleton". *Nature*. Jun 11; 522(7555):212-5. (2015).
29. Takahashi KZ, Lewek MD, **Sawicki GS**, "A neuromechanics-based powered ankle exoskeleton to assist walking post-stroke: A feasibility study". *J Neuroeng Rehabil*. Feb 25; 12:23. (2015).
28. Farris DJ, Hampton AS, Lewek MD, **Sawicki GS**, "Revisiting the mechanics and energetics of walking in individuals with chronic hemiparesis following stroke: From individual limbs to lower-limb joints". *J Neuroeng Rehabil*. Feb 27; 12(1): 24 (2015).
27. Mahon C, Farris DJ, **Sawicki GS**, Lewek MD, "Individual limb mechanical analysis of gait following stroke". *J Biomech*. Apr 13; 48(6):984-9. (2015).
- *26. Zelik K, Takahashi KZ, **Sawicki GS**, "Six degree-of-freedom analysis of hip, knee, ankle and foot provides updated understanding of biomechanical work during human walking". *J Exp Biol*. Mar; 218(Pt 6): 876-86. (2015).
 *This article was featured in the column 'Inside JEB'.
25. Farris DJ, Hicks J, Delp S, **Sawicki GS**, "Musculoskeletal modelling deconstructs the paradoxical effects of elastic ankle exoskeletons on plantar-flexor mechanics and energetics during hopping". *J Exp Biol*. Nov 15; 217(Pt 22) 4018-28. (2014).
24. Robertson BD, Farris DJ, **Sawicki GS**, "More is not always better: Modeling the effects of elastic exoskeleton compliance on underlying ankle muscle-tendon dynamics". *Bioinspir. Biomim*. Nov 24; 9(4): 046018. (2014).
23. Robertson BD, **Sawicki GS**, "Exploiting elasticity: Modeling the influence of neural control on the mechanics and energetics of ankle muscle-tendons during human hopping". *J Theor Biol*. Mar 16. [Epub ahead of print] (2014).
22. Shamaei K, **Sawicki GS**, Dollar A, "Estimation of quasi-stiffness of the human hip in the stance phase of walking". *PLoS One*. 8(12): e81841. Epub Dec 9. (2013).
21. Matta P, Myers J, **Sawicki GS**, "The influence of available reaction time on ball-player impact probability in youth baseball". *Sports Health*. Mar;7(2):154-60. 2015. Epub (2013)
20. Farris DJ, Robertson, BD, **Sawicki GS**, "Passive elastic exoskeletons reduce soleus muscle force but not work in human hopping". *J Appl Physiol*. Epub Jun 20. (2013).
19. Shamaei K, **Sawicki GS**, Dollar A, "Estimation of quasi-stiffness and propulsive work of the human ankle in the stance phase of walking". *PLoS One*. 8(3): e59935. Epub Mar 21. (2013).
18. Shamaei K, **Sawicki GS**, Dollar A, "Estimation of quasi-stiffness of the human knee in the stance phase of walking". *PLoS One*. 8(3): e59993. Epub Mar 22. (2013).

17. Farris DJ, **Sawicki GS**, "Linking the mechanics and energetics of human hopping with passive-elastic ankle exoskeletons". *J Appl Physiol*. Dec 15; 113(12): 1862-72. Epub Oct 11. (2012).
16. Richards CR, **Sawicki GS**, "Elastic recoil can either amplify or attenuate muscle-tendon power, depending on inertial versus fluid dynamic loading". *J Theor Biol*. Aug 8; 313C: 68-78. (2012).
15. Wutzke C, **Sawicki GS**, Lewek M, "The influence of a unilateral fixed ankle on metabolic and mechanical demands during walking in unimpaired young adults". *J Biomech*. Sept 21; 45(14): 2405-10. Epub Jul 26. (2012).
14. Farris D, **Sawicki GS** "Human medial gastrocnemius force-velocity behavior shifts with locomotion speed and gait". *Proc Natl Acad of Sci USA*. Jan 17; 109(3):977-82. Epub Jan 4. (2012).
13. Farris D, **Sawicki GS**, "The mechanics and energetics of human walking and running: a joint-level perspective". *J R Soc Interface*. Jan 7; 9(66): 110-8. Epub 2011 May 25. (2012).
12. **Sawicki GS**, Lewis CL, Ferris DP, "It pays to have a spring in your step". *Exerc Sport Sci Rev*. 37(3):130-8 (2009).
11. **Sawicki GS**, Ferris DP, "A pneumatically powered knee-ankle-foot orthosis (KAFO) with myoelectric activation and inhibition". *J Neuroeng Rehabil*. 6(1):23 (2009).
10. **Sawicki GS**, Ferris DP, "Mechanics and energetics of incline walking with robotic ankle exoskeletons". *J Exp Biol*. 212:32-41 (2009).
9. **Sawicki GS**, Ferris DP, "Powered exoskeletons reveal the metabolic cost of ankle plantar flexor work during level walking with increasing step length". *J Exp Biol*. 212:21-31 (2009).
- *8. **Sawicki GS**, Ferris DP, "Mechanics and energetics of level walking with powered ankle exoskeletons". *J Exp Biol*. 211:1402-1413 (2008).
*This article was highlighted in the column 'Inside JEB'.
7. Ferris DP, **Sawicki GS**, Daley, MA, "A physiologist's perspective on robotic exoskeletons for human locomotion". *International Journal of Humanoid Robotics*. 4:507-528 (2007).
6. Domingo A, **Sawicki GS**, Ferris DP, "Kinematics and muscle activity of individuals with incomplete spinal cord injury during treadmill stepping with and without manual assistance". *J Neuroengineering Rehabil*. 4:32 (2007).
5. **Sawicki GS**, Domingo A, Ferris DP, "The effects of powered ankle-foot orthoses on joint kinematics and muscle activation during walking in individuals with incomplete spinal cord injury". *J Neuroengineering Rehabil*. 3:3 (2006).
4. Gordon KE, **Sawicki GS**, Ferris DP, "Mechanical performance of artificial pneumatic muscles to power an ankle-foot orthosis". *J Biomech*. 39(10):1832-41 (2006).
3. Ferris DP, Gordon KE, **Sawicki GS**, Peethambaran A, "An improved powered ankle-foot orthosis using proportional myoelectric control". *Gait Posture*. 23(4): 425-28 (2006).
2. Ferris DP, **Sawicki GS**, Domingo A, "Powered lower limb orthoses for gait rehabilitation". *Top Spinal Cord Inj Rehabil*. 11(2):34-49 (2005).

- 1a. **Sawicki GS**, Hubbard M, Stronge WJ, “Reply to Comment on “How to hit home runs: Optimum baseball swing parameters for maximum range trajectories,” by G. S. Sawicki, M. Hubbard, and W. J. Stronge [Am. J. Phys. 71(11):1152-62 (2003)]”. *Am J Phys.* 73(2):185-89 (2005).
- *1. **Sawicki GS**, Hubbard M, Stronge WJ, “How to hit homeruns: Optimum bat swing parameters for maximum range trajectories”. *Am J Phys.* 71(11):1152-62 (2003).
 *This article was highlighted in Science: 202.1655 (5 Dec 2003) and on the NPR radio program 'Day to Day' with Mike Pesca and Ira Flatow.

Engineering Conference Papers (Peer-Reviewed)

4. Elliot G, **Sawicki GS**, Marecki A, Herr H, "The biomechanics and energetics of human running using an elastic knee exoskeleton". *IEEE Int Conf Rehabil Robot.* 2013 Jun; 2013:6650418. (2013).
3. Robertson BD, **Sawicki GS**, “Influence of a parallel spring-loaded exoskeleton on ankle muscle-tendon dynamics during simulated human hopping”. *Conf Proc IEEE Med Biol Soc.* 2011; 2011:583-6. (2011).
- *2. Wiggin MB, Collins SH, **Sawicki GS**, “An exoskeleton using controlled energy storage and release to aid ankle propulsion”. *IEEE Int Conf Rehabil Robot.* 2011 Jun 29-Jul 1: 5975342 (2011).
 *This article was highlighted in Nature: 503.S16-17 (14 Nov 2013).
1. **Sawicki GS**, Gordon, KE, Ferris DP, “Powered lower limb orthoses: Applications in Motor Adaptation and Rehabilitation”. *IEEE Int Conf Rehabil Robot.* 2005 Jun 28-Jul 1: 206-11 (2005).

Journal Manuscripts in Review

1. Blau SR, Davis LM, Gorney AM, Dohse CS, Williams KD, Lim JH, Pfitzner WG, Laber E, **Sawicki GS**, Olby NJ, (In Review) “Quantifying center of pressure variability in chondrodystrophoid dogs”. *The Veterinary Journal.* (2017).

Journal Manuscripts in Preparation (data collection complete) or Planned (collection on-going)

9. Nuckols R, Riemer R, **Sawicki GS**, (In Prep) “Mechanics and energetics of walking and running up and downhill: A joint-level perspective”. *Journal of Experimental Biology.* (2017).
8. Westbrook A, Lewek MD, Huang H, **Sawicki GS**, (In Prep) “An ankle foot orthosis with real-time vibrotactile biofeedback to encourage push-off and prevent drop foot: A feasibility study”. *Journal of Neuroengineering and Rehabilitation.* (2017).
7. Browne M, DiMeo A, Franz J, **Sawicki GS**, (In Prep) “Real-time feedback can alter center of pressure trajectory during human walking”. *Journal of Biomechanics.* (2017).
6. Doering J, Franz J, Cole J, **Sawicki GS**, (In Prep) “Influence of muscle and tendon stiffness on cyclic contraction dynamics”. *Journal of Biomechanics.* (2017).
5. Nuckols R, **Sawicki GS**, (In Prep) “Speed-stiffness coupling during walking with passive elastic ankle exoskeletons”. *Science Robotics.* (2017).
4. Nuckols R, Dick TJ, **Sawicki GS**, (In Prep) “Elastic ankle exoskeletons reduce soleus force but not work during human walking”. *Proceedings of the Royal Society B: Biological Sciences.* (2017).

3. **Sawicki GS**, Nuckols R (In Prep) “Biologically inspired wearable robots for the lower limbs”. *Exercise and Sport Science Reviews*. (2017).
2. Newzek T, Wall C, Schmitt DO, Patek SN, **Sawicki GS** (In Prep) “Hurry up and get out of the way!: Exploring the limits on antagonist muscle-based catch systems for muscle-tendon power amplification”. *Proceedings of the Royal Society B: Biological Sciences*. (2017).
1. Giest T, Nuckols R, Dick TJ, Lewek MD, **Sawicki GS** (In Prep) “Effects of powered ankle assistance on walking speed and economy during post-stroke walking”. *Journal of Neuroengineering and Rehabilitation* (2017).

Patents/IP Disclosures

3. Wiggin MB, **Sawicki GS**, “Low power electromechanical unidirectional rotary clutch”.
 *Provisional Patent Application #61/894,272 filed **10/22/2013**.
 *International Patent Application PCT/US2014/061,668 filed **10/22/2014**.
Pub. No.: WO 2015/061380 A1; **Pub. Date:** **4/30/2015**.
2. Wiggin MB, Westbrook AE, **Sawicki GS**, Willson AK, Rahhal TB, Barnette WC, Lasater KE, “Ankle-foot orthotic devices with integrated vibrotactile biofeedback and related methods”.
 *Non-Provisional Patent Application #13/886,247 filed **05/02/2013**.
Pub. No.: US 2013/0296741 A1; **Pub. Date:** **11/07/2013**.
1. Wiggin MB, **Sawicki GS**, Collins SH, “Apparatus and clutch for using controlled storage and release of mechanical energy to aid locomotion”.
 *Non-Provisional Patent Application #13/586,528 filed **08/15/2012**.
Pub. No.: US 2013/0046218 A1; **Pub. Date:** **02/21/2013**.
Issued Nov. 15 2016: US No. 9,492,302

Current Grant Support

-Extramural:

3. Department of Defense (NSRDEC - US Army Soldier Systems Center-Natick)
 “Optimizing hip, knee and ankle exoskeleton assistance during walking and running at various speeds and loads”.

January 2017-December 2020

Primary Investigator: S.H. Collins (Carnegie Mellon - ME); co-I, G.S. Sawicki

Award: **575,000\$**

***AIM:** To build and test a lower-limb powered hip, knee, ankle exoskeleton for able-bodied humans.

2. National Institutes of Health (NIH) R21

“Robotic ankle to restore symmetry and reduce energy cost of walking post-stroke”.

September 2014-September 2017

Primary Investigator: G.S. Sawicki; co-I, M.D. Lewek (University of North Carolina - Chapel Hill)

Award: **411,000\$**

***AIM:** To examine long-term effects of a pneumatically powered wearable robotic device with force-gated proportional myoelectric control on walking mechanics and energetics in participants with post-stroke hemiplegia.

1. National Robotics Initiative (NRI)/National Institutes of Health (NIH) R01

“NRI: Novel platform for rapid exploration of robotic ankle exoskeleton control strategies to augment healthy or restore post-stroke locomotion”.

September 2013-September 2018

Primary Investigator: G.S. Sawicki; co-I, S.H. Collins (Carnegie Mellon University - funded by NSF)

Award: **750,000\$**

***AIM:** To build a state of the art ankle exoskeleton testbed and evaluate locomotion performance during mechanically assisted walking using different control strategies in both healthy and post-stroke populations.

-Intramural:

N/A.

Pending Grant Support

-Extramural:

1. National Science Foundation (NSF)

“Optimizing a powered prosthesis for trans-femoral amputees: Effects of varying knee and ankle power on physiological performance”.

Submitted 10/2016.

Primary Investigator: G.S. Sawicki; co-PI Helen Huang

Award: 371,355\$

1. Army Research Office (ARO)

“Biorobotic testbed to elucidate fundamental form-function relationships and maximize performance in musculotendon systems”.

Submitted 9/2014.

Primary Investigator: G.S. Sawicki

Award: 400,000\$

-Intramural:

N/A

Past Grant Support

-Extramural:

4. US-Israel Binational Science Foundation (BSF) Start-up Grant

“An integrated framework linking ankle muscle-tendon mechanics and energetics during human locomotion”.

October 2012-September 2015

Primary Investigators: G.S. Sawicki and R. Riemer (Ben-Gurion University of the Negev)

Award: **150,000\$**

***AIM:** To develop and apply a novel theoretical and experimental framework for studying the relationship between muscle-tendon unit work and metabolic energy use at the ankle joint during an isolated bouncing task and during uphill walking with and without elastic exoskeletons.

3. Rehabilitation Institute of Chicago (RIC) and National Institutes of Health (NIH) R24 Pilot

“Robotic ankle exoskeleton to restore mechanical symmetry and normalize metabolic energy expenditure of post-stroke walking”

March 2012-August 2013

Primary Investigator: G.S. Sawicki

Award: **50,000\$**

***AIM:** Examine whether a pneumatically powered wearable robotic device to assist the paretic limb in patients with post-stroke hemiplegia can restore fast, stable and economical walking.

2. National Center for Simulation in Rehabilitation Research (NCSRR), "OpenSim framework to evaluate effects of robotic exoskeletons on individual muscle-tendon mechanics during walking"
March 2012

Primary Investigator: G.S. Sawicki

Award: **5,000\$ for Travel**

***AIM:** Develop an OpenSim computer modeling framework to evaluate individual muscle-level dynamics during walking with robotic ankles in both neurologically intact and hemiplegic populations.

1. National Institutes of Health (NIH) National Research Service Award F32
"Influence of tendon elasticity on muscle-tendon contractile element mechanics"
October 2008 - September 2011 (Completed August 2009)

Impact/Priority Score:130 (11%)

Primary Investigator: G.S. Sawicki

Award: **65,000\$ (NIH Post Doc Salary for 1.5 yrs.)**

***AIM:** Determine how elastic tissues in series with muscle fascicles influence the mechanics of force/work production during cyclic contractions in vitro in frog muscle.

-Intramural:

8. NCSU Research and Innovation Seed Funding (RISF) Program

"Relationship between gait analysis, MRI findings and response to potassium channel blockade in chronically paralyzed dogs: A personalized medicine pilot study".

January 2015-December 2015

Primary Investigator: Natasha Olby (NCSU CVM); co-I, G.S. Sawicki; co-I, E.B. Laber

Award: **17,800\$**

***AIM:** To examine the relationship between detailed kinematic gait characteristics, MRI features and response to 4-aminopyridine in a group of chronically paralyzed dogs, in order to identify predictors of drug response.

7. NCSU Rehabilitation Engineering Center (REC) Pilot

"Reverse-engineering musculoskeletal design to inform clinical interventions for ankle-foot related pathologies".

May 2014-April 2015

Primary Investigator: G.S. Sawicki; co-I, M. Gross (UNC Physical Therapy)

Award: **25,000\$**

***AIM:** To use custom in-sole foot orthoses in order to gain insight into the interaction between foot stiffness and the muscle-tendon dynamics of the ankle plantarflexors.

6. NCSU Rehabilitation Engineering Center (REC) Pilot

"Targeted, in vivo expression of channelrhodopsin-2 in peripheral nerves"

January 2013-December 2013

Primary Investigators: G.S. Sawicki and P. Dayton (UNC BME)

Award: **25,000\$**

***AIM:** Assess the feasibility of using focused ultrasound and microbubbles to deliver a custom plasmid construct for in vivo expression of ChR2 to optically control skeletal muscle contraction in vivo.

5. NCSU Chancellor's Innovation Fund (CIF) Grant

"A passive-elastic ankle exoskeleton using controlled energy storage and release (CESR) to aid propulsion during human walking".

July 2012-June 2013

Primary Investigator: G.S. Sawicki

Award: **75,000\$**

***AIM:** To develop and test ‘energy neutral’ elastic ankle exoskeletons and two novel clutching mechanisms along with springs of varying stiffnesses during both unimpaired and post-stroke walking. Pilot data will be used to obtain licensing agreements with established companies or establish a start-up company.

4. NCSU Rehabilitation Engineering Center (REC) Pilot

“Linking mechanics and energetics of post-stroke locomotion”

January 2012-June 2013

Primary Investigators: G.S. Sawicki and M. Lewek (UNC Physical Therapy)

Award: **25,000\$**

***AIM:** Assess lower-limb joint mechanics and metabolic energy expenditure of stroke patients and matched healthy controls during walking at different speeds and on different surface gradients.

3. North Carolina Translational and Clinical Sciences Institute (NCTraCS)

“Robotic ankle exoskeletons to restore gait symmetry post-stroke”

August 2010-September 2011

Primary Investigator: G.S. Sawicki

Award: **50,000\$**

***AIM:** Examine whether pneumatically powered ankle exoskeleton providing push-off power to the hemiparetic limb can restore gait symmetry and reduce energy expenditure during human walking post-stroke.

2. North Carolina State University College of Engineering Faculty Research and Professional Development Fund (FRPD)

“A passive-elastic ankle exoskeleton to reduce energy expenditure during human walking”

July 2010-June 2011

Primary Investigator: G.S. Sawicki

Award: **7,000\$**

***AIM:** Determine whether an ankle exoskeleton without any motors, batteries or electronics can reduce the metabolic cost of human walking.

1. University of Michigan Rackham Graduate School Pre-Doctoral Fellowship

“Mechanics and energetics of walking with powered exoskeletons”

September 2005-August 2006

Primary Investigator: G.S. Sawicki

Award: **22,000\$ (12-month grad stipend)**

***AIM:** Evaluate the human physiological response during walking with powered ankle exoskeletons at different speeds and grades.

Grant Proposals (submitted - not funded)

10/2016 Department of Defense (STTR Phase I)

“Optimizing performance of an unpowered foot-ankle prosthesis using emulator-based experimentation and musculoskeletal simulation”.

Primary Investigator: Joshua Caputo (HuMoTech LLC); co-PI, G.S. Sawicki

Award: 150,000\$ Score: Not Available

8/2016 National Institutes of Health (NIH) R21

“Wearable ultrasound technology for continuous monitoring of muscle dynamics during human locomotion”.

Primary Investigator: Omer Oralkan (NCSU ECE); co-Is, G.S. Sawicki and H. Krim

Award: ~400,000 (~50k Sawicki) Score: Impact 50: Percent 47+

11/2015 Department of Defense (OPORP)

“Wearable ultrasound imaging technology for continuous monitoring of muscle dynamics during human locomotion”.

Primary Investigator: Omer Oralkan (NCSU EECS); co-I, G.S. Sawicki; co-I, H. Krim

Award: 500,000\$ Score: 2.5/5 (1 highest) = Good

11/2015 Department of Defense (OPORP)

“A modeling and simulation framework for prescription of passive-elastic ankle-foot prostheses”.

Primary Investigator: Katherine Saul (NCSU MAE); co-I, G.S. Sawicki

Award: 500,000\$ Score: 2.1/5 (1 highest) = Good

2/2015 National Institutes of Health (NIH) R01

“Wearable ultrasound technology for continuous monitoring of muscle dynamics during human locomotion”.

Primary Investigator: Omer Oralkan (NCSU ECE); co-Is, G.S. Sawicki and H. Krim

Award: ~2,500,000\$ (~500k Sawicki) Score: ND

1/2015 National Science Foundation (NSF)

“The role of proprioception in the adaptation toward economical gait patterns”.

Primary Investigator: Jesse Dean (Med. U. South Carolina); co-I G.S. Sawicki

Award: ~500,000\$ (~75k Sawicki) Score: Medium Priority

1/2015 National Science Foundation (NSF) Integrative and Organismal Systems (IOS)

“IOS PreProposal: Collaborative Research: Mapping form to function: Linking musculoskeletal morphology to muscle energy budget in bouncing gaits”.

Primary Investigators: G.S. Sawicki and C.P. McGowan (University of Idaho)

Award: ~1,000,000\$ (~500k Sawicki) Score: Medium Priority

8/2014 National Science Foundation (NSF) Integrative and Organismal Systems (IOS)

“Collaborative Research: Mapping form to function: Linking musculoskeletal morphology to muscle energy budget in bouncing gaits”.

Primary Investigator: G.S. Sawicki / C.P. McGowan (University of Idaho)

Award: ~1,000,000\$ (~500k Sawicki) Score: Medium Priority

2/2014 NCSU Rehabilitation Engineering Center (REC) Pilot

“Optimization of Clubfooted Walking with a Dynamic Foot Abduction Brace”

Primary Investigators: E. Champion (UNC Orthopaedics), A. DiMeo, G.S. Sawicki,

Award: 25,000\$

10/2013 NCSU Research Innovation Seed Funding (RISF)

“Reverse-Engineering Musculoskeletal Design to Inform Clinical Interventions for Ankle-Foot Related Pathologies”

Primary Investigators: G.S. Sawicki and M. Gross (UNC Physical Therapy)

Award: 37,500\$

9/2013 NCSU Rehabilitation Engineering Center (REC) Pilot

“Mechanics and Energetics of Walking with Ponseti-Treated Clubfoot”

Primary Investigators: E. Champion (UNC Orthopaedics), A. DiMeo, G.S. Sawicki

Award: 25,000\$

3/2013 Human Frontiers in Science

“Discovering optimality laws for legged locomotion using an animal-machine interface with biofeedback”.

Primary Investigator: G.S. Sawicki / co-I's J. Rubenson (University of Western Australia), A. Spence (Royal Veterinary College, UK), C. Walsh (Wyss Institute, Harvard University)

Award: ~300,000\$

2/2013 NCSU Research Innovation Seed Funding (RISF)

“Exploiting functional interaction between ankle and foot structures during human locomotion: Insights for next generation ‘bio-inspired’ devices to aid mobility”

Primary Investigators: G.S. Sawicki and M. Gross (UNC Physical Therapy)

Award: 37,500\$

1/2013 National Science Foundation (NSF) Integrative and Organismal Systems (IOS)

“IOS Preliminary Proposal: Collaborative Research: Linking Metabolic Energy Budget to Muscle-Tendon Morphology and the Mechanical Demand of Locomotion”

Primary Investigator: G.S. Sawicki / C.P. McGowan (University of Idaho)

Award: - ~1,000,000\$ (~500k Sawicki) Score: Medium Priority

8/2012 National Science Foundation (NSF) Integrative and Organismal Systems (IOS)

“Collaborative Research: Understanding the link between muscle dynamics and metabolic cost”.

Primary Investigator: G.S. Sawicki / C.P. McGowan (University of Idaho)

Award: ~1,000,000\$ (~500k Sawicki) Score: Medium Priority

11/2011 National Science Foundation (NSF) National Robotics Initiative (NRI)

“Collaborative research: NRI Small: Rapid exploration of assistive ankle control strategies for locomotion using a novel co-robot testbed”. Primary Investigator: G.S. Sawicki / S.H. Collins (Carnegie Mellon University) - Award: ~2,000,000\$ (~800k Sawicki) Score: Highly Competitive

11/2011 Defense Advanced Research Projects Administration (DARPA); “Wearable Robotic Simulator for design of Warrior Web control and sensing” - Primary Investigator: H. Herr, co-Investigator: G.S. Sawicki - Sub-Contract Award: 391,600\$

07/2011 National Center for Simulation in Rehabilitation Research (NCSRR); “OpenSim framework to evaluate effects of robotic exoskeletons on individual muscle-tendon mechanics during walking” - Primary Investigator: G.S. Sawicki - Award: 25,000\$

06/2011 National Institutes of Health (NIH) R21; “Robotic ankle to restore symmetry and reduce energy cost of walking post-stroke”. - Primary Investigator: G.S. Sawicki - Award: 275,000\$ - Impact/Priority Score: 46 (42%).

04/2011 North Carolina State University Chancellor's Innovation Fund (CIF); “A passive-elastic ankle exoskeleton using controlled energy storage and release (CESR) to aid propulsion during human walking”. - Primary Investigator: G.S. Sawicki - Award: 75,000\$

04/2011 David and Lucille Packard Foundation Fellowship for Science and Engineering, “The Physiology of Wearable Robotics (PoWeR): Bridging the gap between human and machine” - Primary Investigator: G.S. Sawicki - Award: 875,000\$

12/2010 Wallace H. Coulter Translational Research Awards in Biomedical Engineering, “A passive elastic ankle exoskeleton using controlled energy storage and release to aid propulsion during human walking” - Primary Investigator: G.S. Sawicki - Award: 180,000\$

11/2009, 11/2010 National Institutes of Health (NIH) Loan Repayment Program (LRP)

“Powered ankle-orthoses to restore limb mechanics and reduce metabolic cost of

walking post-stroke” - Primary Investigator: G.S. Sawicki - Award: <=35,000\$

Funded Training Grants for my Doctoral and Post Doctoral Trainees

1. National Center for Simulation in Rehabilitation Research (NCSRR), “The effects of spring-loaded ankle exoskeletons on individual muscle-tendon mechanics during human hopping”

June-August 2012

Primary Investigator: D.J. Farris (Post Doc)

Award: **15,000\$ Stipend**

***AIM:** Develop an OpenSim computer modeling framework to evaluate individual muscle-level dynamics during hopping with spring-loaded ankles of various stiffnesses.

Training Grants for Doctoral and Postdoctoral Trainees (submitted - not funded)

4/2013, 11/2013 National Institutes of Health (F32) “Functional Interaction between Ankle Joint and Foot Structures during Locomotion”

Primary Investigator: K.Z. Takahashi (Post Doc)

Award: NIH Postdoctoral salary support

Impact Priority =48 (8/2013) = NR (3/2014)

9/2013 Burroughs Wellcome Foundation Career Awards at the Scientific Interface “The interplay of ankle and foot musculoskeletal structures during human locomotion”

Primary Investigator: K.Z. Takahashi (Post Doc)

Award: Postdoctoral salary/research support = 500,000\$

7/2013 Helen Hay Whitney Foundation “Functional Interaction between Ankle Joint and Foot Structures during Locomotion”

Primary Investigator: K.Z. Takahashi (Post Doc)

Award: Postdoctoral salary/research support

Invited Talks

- *41.** Symposium on Spatial Scale and Structural Heterogeneity in Skeletal Muscle Performance: “Perturbing the work loop paradigm to unravel the neuromechanics of unsteady locomotion”- Annual Meeting of the Society for Integrative and Comparative Biology (SICB), San Francisco, California - January 4, **2018**.
- *40.** Tutorial: “Biologically-inspired concepts guiding lower-limb exoskeleton design” - XXVI Congress of the International Society of Biomechanics, Brisbane, QL, Australia - July 23, **2017**.
- *39.** 12th Annual Meeting of Dynamic Walking: “Humans falling in holes: How does the human lower-limb handle perturbations?” - Mariehamn, Aaland Islands, Finland - June 4, **2017**.
- *38.** Workshop on Mechanics of Human Locomotion and the Development of Wearable Robotic Systems, Meeting of IEEE International Conference on Robotics and Automation (ICRA), “Biologically inspired lower-limb exoskeletons: Tuning the neuromechanics of human-machine interaction for improved locomotion performance” - Singapore - May 29, **2017**.
- 37.** Special Session on Neuromechanical Modeling for Wearable Assistive Technologies, 3rd International Conference on NeuroRehabilitation (ICNR), 2nd International Conference on Wearable robotics (WeRob), “Merging models and experiments to examine changes in

musculotendon dynamics during locomotion with lower-limb exoskeletons” - Segovia, Spain - October 18, **2016**.

36. Mechanical Engineering and Biological Sciences Joint Seminar Series, Georgia Institute of Technology, “Biologically inspired lower-limb exoskeletons: Tuning the neuromechanics of human-machine interaction for improved locomotion performance” - Atlanta, GA – September 15, **2016**.
35. Workshop on Assistive Robotic Devices for Dynamic Locomotion, 12th Meeting of Robotics: Science and Systems (RSS), “A biologically inspired approach to lower-limb exoskeleton design” - Ann Arbor, MI - June 18-22, **2016**.
34. Integrative Physiology Seminar Series, University of Colorado, “A bio-robotic approach for understanding elastic mechanisms in locomotion” - Boulder, CO - April 18, **2016**.
33. American Society of Biomechanics--Rocky Mountain Regional Meeting, “Keynote: A biologically inspired approach to lower-limb exoskeleton design”- Estes Park, CO - April 15, **2016**.
32. WeaRAcon 16, Wearable Robotic Association Conference, “Keynote: A biologically inspired approach to lower-limb exoskeleton design”- Phoenix, AZ - February 10, **2016**.
31. Mechanical Engineering Seminar Series, Arizona State University, “A biologically inspired approach to lower-limb exoskeleton design”- Tempe, AZ - November 13, **2015**.
30. Mechanical and Aerospace Engineering Seminar Series, University of Michigan “A biologically inspired approach to lower-limb exoskeleton design” - Ann Arbor, MI - November 2, **2015**.
29. Applied Physiology Seminar Series, Georgia Institute of Technology, “A bio-robotic approach for understanding elastic mechanisms in locomotion” - Atlanta, GA - September 9, **2015**.
28. 7th International Symposium on Adaptive Motion of Animals and Machines (AMAM), Massachusetts Institute of Technology, “Spring-loading locomotion: Considering muscle-tendon dynamics on the human side of the human-machine interface”- Boston, MA - June 21, **2015**.
27. Prosthetics and Orthotics Capstone Colloquium Series, Georgia Institute of Technology, “A biologically inspired approach to lower-limb exoskeleton design”- Atlanta, GA - April 17, **2015**.
26. Mechanical Engineering Seminar Series, Vanderbilt University, “Spring-loading human locomotion: Taking inspiration from biology to improve lower-limb exoskeleton design.” - Nashville, TN - April 13, **2015**.
25. The Robotics Institute Seminar Series, Carnegie Mellon University, “Spring-loading human locomotion: Taking inspiration from biology to improve lower-limb exoskeleton design.” - Pittsburgh, PA - October 24, **2014**.
24. 7th World Congress on Biomechanics Symposium: Dynamic Walking, “Applying principles of dynamic walking in bio-inspired exoskeleton designs.” - Boston, MA - July 11, **2014**.
23. Annual Meeting of the Gait and Clinical Movement Analysis Society (GCMAS) - Invited Tutorial, “From Body to Joints to Muscles: An integrative multi-scale assessment of ankle and foot function in human locomotion.” (co Presenting with K. Takahashi, D. Farris, B. Robertson and S. Piazza) - Newark, DE - June 24, **2014**.
22. Simtk.org - OpenSim Webinar, “Developing modeling and simulation tools to optimize performance of lower-limb exoskeletons for enhanced human locomotion.” - International live webcast from Stanford University, Palo Alto, CA - February 6th, **2014**.

21. National Science Foundation - 3rd Annual Winter Workshop on Neuromechanical Locomotion, "Muscle-tendon performance: Linking morphology, environment dynamics and task demand." - Princeton, NJ - January 31, **2014**.
20. Human Movement Science Curriculum Seminar Series, University of North Carolina at Chapel Hill, "User controlled robotic ankle exoskeletons to restore gait symmetry post-stroke." - Chapel Hill, NC - November 13, **2013**.
19. Department of Mechanical Engineering and Materials Science, Yale University, "Biologically-inspired wearable robotics to assist human locomotion." - New Haven, Connecticut - October 30, **2013**.
18. Motor Behavior Research Network: University of North Carolina at Greensboro, "In silico and in vitro approaches for optimizing design of elastic exoskeletons for human locomotion assistance." - Greensboro, NC - October 17, **2013**.
17. Society of Experimental Biology Symposium: Muscle-tendon biomechanics, "Muscle-tendon interaction during human locomotion with elastic exoskeletons." - Valencia, Spain - July 4, **2013**.
16. Department of Biology, Northeastern University, "Biologically-inspired wearable robotics to assist human locomotion." - Boston, Massachusetts - November 26, **2012**.
15. Weldon School of Biomedical Engineering, Purdue University, "Biologically-inspired wearable robotics to assist human locomotion." - West Lafayette, Indiana - October 17, **2012**.
14. Department of Kinesiology, Pennsylvania State University, "Human PoWeR- the Physiology of Wearable Robotics." - State College, Pennsylvania - December 7, **2011**.
13. 6th Annual Meeting of Dynamic Walking: Friedrich-Schiller University, "Compliant muscle-tendon interaction during locomotion with robotic assistance." - Jena, Germany - July 20, **2011**.
12. Department of Physical Medicine and Rehabilitation, UNC-Chapel Hill. "Powered ankle-foot orthoses to restore walking mechanics following spinal cord injury and stroke." - Chapel Hill, North Carolina - September 8, **2010**.
11. 6th World Congress on Biomechanics Symposium: Muscle-Tendon Interaction, "Benefits of compliant muscle-tendon architecture in steady and accelerative movements." - Singapore, Indonesia - August 4, **2010**.
10. 5th Annual Meeting of Dynamic Walking: Massachusetts Institute of Technology, "Mechanics and control of a compliant muscle-tendon during cyclic contractions." - Boston, Massachusetts - July 9, **2010**.
9. Annual Meeting of the Gait and Clinical Movement Analysis Society (GCMAS) - Invited Tutorial, "How to build a powered lower-limb exoskeleton." (Co-presenter with D.P. Ferris, K.E. Gordon, C.L. Lewis) - Miami, Florida - May 12, **2010**.
8. 33rd Annual Meeting of the American Society of Biomechanics, "How to build a powered lower-limb exoskeleton: A tutorial." (Co-presenter with D.P. Ferris, K.E. Gordon C.L. Lewis - State College, Pennsylvania - August 26, **2009**.
7. Department of Kinesiology, University of Massachusetts, "It pays to have a spring in your step." - Amherst, Massachusetts - April 21, **2009**.

6. Concord Field Station Structure-Function Seminar Series, Harvard University, "It pays to have a spring in your step: Insights from human walking and isolated frog muscle-tendon." - Bedford, Massachusetts - April 15, **2009**.
5. Society of Experimental Biology Symposium: Integrating the Mechanics and Energetics of Locomotion, "Tendon elasticity influences the mechanics, energetics and control of muscle contraction: Insights from human walking and isolated frog muscle-tendon." - Marseille, France - July 8, **2008**.
4. Joint Department of Biomedical Engineering, University of North Carolina at Chapel Hill and North Carolina State University, "Powered Exoskeletons: Neuromechanics and energetics at the human-machine interface." - Raleigh, NC - April 16, **2008**.
3. Department of Orthopaedics, Brown University Medical School, Foot and Ankle Group Seminar, "Mechanics and energetics of walking with powered ankle exoskeletons," - Providence, RI - November, **2007**.
2. Department of Mechanical Engineering, University of California at Berkeley, Human Power Augmentation Group Seminar, "Metabolic cost of ankle joint mechanical work," - Berkeley, CA - August, **2007**.
1. Department of Ecology and Evolutionary Biology, Brown University, Functional Morphology Group Seminar, "Mechanics and energetics of walking with powered ankle exoskeletons." - Providence, RI - February, **2007**.

*Indicates scheduled talks not yet delivered.

Work Presented at Scientific Meetings (unsolicited, as lead author)

17. **Sawicki GS**, Nardelli P, Cope T (Poster) "Mechanics and energetics of human hopping with a passive-elastic ankle exoskeleton". 46th Annual Meeting of the Society for Neuroscience (SfN), November 12-16, San Diego, California (2016).
16. **Sawicki GS**, Farris, DJ (Talk) "Mechanics and energetics of human hopping with a passive-elastic ankle exoskeleton". 34th Annual Meeting of the American Society of Biomechanics, August 18-21, Providence, Rhode Island (2010).
15. **Sawicki GS**, Roberts TJ (Talk) "Muscle-tendon architecture shapes conditions for isometric force production". Annual Meeting of the Society for Integrative and Comparative Biology, January 5, Seattle, Washington (2010).
14. **Sawicki GS**, Roberts TJ (Talk) "Influence of load on power amplification in a compliant muscle-tendon". Annual Southeast Regional Meeting of the Society for Integrative and Comparative Biology, September 26, Chapel Hill, North Carolina (2009).
13. **Sawicki GS**, Roberts TJ (Poster) "Isometric force production requires asymmetric muscle-tendon length trajectory". 33rd Annual Meeting of the American Society of Biomechanics, August 26-29, State College, Pennsylvania (2009).
12. **Sawicki GS**, Sheppard P, Roberts TJ (Talk) "Mechanical power amplification in a compliant muscle-tendon working on an inertial load in gravity". Annual Meeting of the Society of Experimental Biology, June 29 - July 1, Glasgow, Scotland (2009).

11. **Sawicki GS**, Azizi E, Roberts TJ (Talk) "Muscle activation timing influences muscle-tendon mechanical performance during cyclic contractions". North American Conference of Biomechanics, August 5-9, Ann Arbor, Michigan (2008).
10. **Sawicki GS**, Azizi E, Roberts, TJ (Poster) "Optimal timing for elastic behavior of a compliant muscle-tendon". Dynamic Walking IV, May 25-29, Delft, Netherlands (2008).
9. **Sawicki GS**, Ferris DP, (Talk) "Mechanics and energetics of level walking with powered ankle exoskeletons". 31st Annual Meeting of the American Society of Biomechanics, August 22-25, Palo Alto, California (2007).
8. **Sawicki GS**, Ferris DP, (Poster) "Mechanics and energetics of incline walking with powered ankle exoskeletons". 31st Annual Meeting of the American Society of Biomechanics, August 22-25, Palo Alto, California (2007).
7. **Sawicki GS**, Ferris DP, (Talk) "Mechanics and energetics of walking with powered ankle exoskeletons". Dynamic Walking III, June 24-30, Mariehamn, Finland (2007).
6. **Sawicki GS**, Ferris DP, (Talk) "Mechanics and control of a knee-ankle-foot orthosis (KAFO) powered with artificial pneumatic muscles". Fifth World Congress of Biomechanics, July 29-August 4, Munich, Germany (2006).
5. **Sawicki GS**, Domingo A, Ferris DP (Talk), "Therapist controlled powered lower limb orthoses to assist locomotor training". XXth Congress of the International Society of Biomechanics and 29th Annual Meeting of the American Society of Biomechanics, August 1-5, Cleveland, Ohio (2005).
4. **Sawicki GS**, Gordon, KE, Ferris DP (Poster), "Powered lower limb orthoses: Applications in Motor Adaptation and Rehabilitation". IEEE 9th International Conference on Rehabilitation Robotics: Frontiers of the Human-Machine Interface, June 28-July 1, Chicago, Illinois (2005).
3. **Sawicki GS**, Domingo A, Ferris DP (Poster), "Powered lower limb orthoses to assist gait rehabilitation after spinal cord injury". The Society for the Neural Control of Movement Annual Meeting, April 12-17, Key Biscayne, Florida (2005).
2. **Sawicki GS**, Peethambaran, A, Ferris DP (Poster), "Powered lower limb orthoses to assist locomotor training". Christopher Reeve Paralysis Foundation Spinal Cord Symposium, March 21-23, Oak Brook, Illinois, USA (2004).
1. **Sawicki GS** (Talk) "A knee-ankle-foot orthosis (KAFO) powered by artificial pneumatic muscles". XIXth Congress of the International Society of Biomechanics, July 6-11, Dunedin, New Zealand, (2003).

*Indicates scheduled meetings not yet attended.

Conference Abstracts (not presented as first author)

51. Dick N, Nuckols R, **Sawicki GS**, (TBD) "Tuned or not? Ultrasound measurements of soleus fascicle dynamics during human walking with elastic ankle exoskeletons". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
50. Doering JA, **Sawicki GS**, (TBD) "From hopping on land to treading in water: Understanding limits on muscle-tendon performance in changing environments". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).

49. Green BA, **Sawicki GS**, Rubenson J (TBD) "Energy cost of walking in a passive-elastic ankle-metatarsophalangeal exoskeleton". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
48. McCall JV, Philius SA, Nuckols RW, **Sawicki GS**, (TBD) "Performance of a powered ankle exoskeleton using neuromuscular model-based control over a range of walking speeds". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
47. Nuckols RW, Dick TJ, Franz JR, **Sawicki GS**, (TBD) "Using elastic ankle exoskeletons to counteract age-related structure-function deficits". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
46. Nuckols RW, **Sawicki GS**, (TBD) "Effect of speed on the mechanics and energetics of walking with an elastic ankle exoskeleton". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
45. Philius SA, McCall JV, Nuckols RW, **Sawicki GS**, (TBD) "Mechanics and energetics of walking with a powered ankle exoskeleton using neuromuscular model-based control -- a parameter study". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
44. Poppo MN, McCain EM, Dick TJ, Saul KR, **Sawicki GS**, (TBD) "Dynamic simulation of elastic ankle exoskeleton effects on plantarflexor muscle-tendon neuromechanics during walking". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
43. Punith LK, McKnight M, Narsipur S, **Sawicki GS**, (TBD) "Positive force feedback allows for faster and safer recovery in perturbed hopping -- at a cost". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
42. Rabani AS, **Sawicki GS**, Riemer R, (TBD) "Prediction equations for leg kinematics and kinetics during slope running". 41st Annual Meeting of American Society of Biomechanics, August 8-11, Boulder, Colorado (2017).
41. Dick TJ, Punith LK, **Sawicki GS**, (Talk) "How do we recover from falling in a hole? A joint-level analysis". XXVI Congress of the International Society of Biomechanics, July 23-27, Brisbane, QL, Australia (2017).
40. Nuckols R, **Sawicki GS**, (Talk) "Effect of elastic ankle exoskeleton assistance on soleus muscle dynamics during walking". XXVI Congress of the International Society of Biomechanics, July 23-27, Brisbane, QL, Australia (2017).
39. Danos N, Holt N, **Sawicki GS**, Azizi E, (Poster) "Modeling muscle-tendon dynamics during walking in aged rats (*Rattus norvegicus*)". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).
38. Doering J, **Sawicki GS**, (Poster) "Changing environment dynamics can spontaneously shift muscle-tendon function during cyclic contractions". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).
37. Giest TN, **Sawicki GS**, (Thematic Poster) "Speed-dependent, proportional myoelectric exoskeleton controller with adaptive gains". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).

36. McKnight M, Narsipur S, **Sawicki GS**, (Poster) "Muscle-tendon model predicts positive force feedback leads to safer, not faster recovery from perturbation". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).
35. Nuckols R, **Sawicki GS**, (Talk) "The goldilocks zone: Interplay of elastic exoskeleton assistance and walking speed on the mechanics and energetics of walking". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).
34. Nuckols R, Giest T, Philius S, **Sawicki GS**, (Poster) "Embodying human plantarflexor muscle-tendon physiology for neuromuscular model-based control of a powered ankle exoskeleton". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).
- *33. Robertson BD, Vadakkevedu S, **Sawicki GS**, (Talk) "An *in vitro* approach for directly observing muscle-tendon dynamics with parallel elastic mechanical assistance". 40th Annual Meeting of American Society of Biomechanics, August 2-5, Raleigh, North Carolina (2016).
*Winner 2016 American Society of Biomechanics Journal of Biomechanics Award.
32. Browne MG, **Sawicki GS**, (Thematic Poster) "Development of a visual biofeedback system for center of pressure modification during gait". 39th Annual Meeting of American Society of Biomechanics, August 5-8, Columbus, Ohio (2015).
31. Doering JA, **Sawicki GS**, (Talk) "Influence of tendon stiffness on muscle-tendon interaction dynamics during cyclic contractions". 39th Annual Meeting of American Society of Biomechanics, August 5-8, Columbus, Ohio (2015).
30. Nuckols RW, Farris DJ, Riemer R, **Sawicki GS**, (Talk) "Redistribution of lower-limb joint power during uphill and downhill walking and running". 39th Annual Meeting of American Society of Biomechanics, August 5-8, Columbus, Ohio (2015).
29. Takahashi KZ, Gross MT, van Werkhoven H, Piazza SJ, **Sawicki GS**, (Poster) "The effects of added foot stiffness on soleus muscle fascicle behavior during human walking". 39th Annual Meeting of American Society of Biomechanics, August 5-8, Columbus, Ohio (2015).
28. Westbrook AE, **Sawicki GS**, (Thematic Poster) "Modifying ankle joint neuromechanics using an ankle foot orthosis with vibrotactile feedback during human walking". 39th Annual Meeting of American Society of Biomechanics, August 5-8, Columbus, Ohio (2015).
27. Bell EA, Takahashi KZ, Rider PM, **Sawicki GS**, Domire ZJ, (Poster) "Effect of plantar fascia stiffness on foot energy absorption during overground walking". 39th Annual Meeting of American Society of Biomechanics, August 5-8, Columbus, Ohio (2015).
26. Farris DJ, **Sawicki GS**, (Talk) "Paradoxical effects of elastic ankle exoskeletons on plantarflexor muscle mechanics and energetics". 7th World Congress of Biomechanics, July 6-11, Boston, Massachusetts (2014).
25. Zelik K, Takahashi KZ, **Sawicki GS**, (Talk) "Positively missing: Reassessing work production in human gait and the implications for assistive technology". 7th World Congress of Biomechanics, July 6-11, Boston, Massachusetts (2014).
- *24. Mizrachi S, Riemer R, **Sawicki GS**, (Poster) "Prediction equations for leg kinematics and kinetics during slope walking and running". 7th World Congress of Biomechanics, July 6-11, Boston, Massachusetts (2014).
*2nd place: WCB M.S. Level Student Paper Award

23. Takahashi KZ, Lewek MD, **Sawicki GS**, (Poster) "A user-controlled powered ankle exoskeleton to drive gait modifications post-stroke". 7th World Congress of Biomechanics, July 6-11, Boston, Massachusetts (2014).
22. Robertson BD, **Sawicki GS**, (Poster) "Unconstrained workloops reveal frequency-phase coupling in compliant muscle-tendon unit". 7th World Congress of Biomechanics, July 6-11, Boston, Massachusetts (2014).
21. Wiggin MB, Collins SH, **Sawicki GS**, (Poster) "Neuromechanics and energetics of walking with a simple passive elastic ankle exoskeleton". 7th World Congress of Biomechanics, July 6-11, Boston, Massachusetts (2014).
20. Mahon CE, Farris DJ, **Sawicki GS**, Lewek MD, "Individual limb mechanical analysis of gait following stroke". 37th Annual Meeting of American Society of Biomechanics, September 4-8, Omaha, Nebraska (2013).
- *19. Takahashi KZ, **Sawicki GS**, "A user-controlled powered ankle exoskeleton to assist gait propulsion post-stroke". 37th Annual Meeting of American Society of Biomechanics, September 4-8, Omaha, Nebraska (2013).
*Top ten nomination for Clinical Biomechanics Award.
18. Farris DJ, **Sawicki GS** "The effects of wearing a spring-loaded ankle exoskeleton on soleus muscle mechanics during two-legged hopping in humans". 36th Annual Meeting of American Society of Biomechanics, August 15-18, Gainesville, Florida (2012).
- *17. Wiggin MB, **Sawicki GS** "A passive elastic exoskeleton reduces the metabolic cost of walking using controlled energy storage and release". 36th Annual Meeting of American Society of Biomechanics, August 15-18, Gainesville, Florida (2012).
*Winner of ASB President's Poster Award.
16. Robertson BD, **Sawicki GS** "More is not always better: Consequences of exoskeleton assistance in a compliant muscle-tendon system". 36th Annual Meeting of American Society of Biomechanics, August 15-18, Gainesville, Florida (2012).
15. Richards, CR, **Sawicki GS** "Power amplification in water: modeling muscle-tendon dynamics during swimming". Annual Meeting of the Society for Integrative and Comparative Biology, January 3-7, Charleston, South Carolina (2012).
14. Wutzke CJ, **Sawicki GS**, Lewek MD "Influence of a fixed ankle on joint mechanics and metabolic cost of walking". 35th Annual Meeting of the American Society of Biomechanics, August 10-13, Long Beach, California (2011).
13. Hampton A, **Sawicki GS** "Mechanics and energetics of post-stroke walking: Towards a muscle-level understanding". 35th Annual Meeting of the American Society of Biomechanics, August 10-13, Long Beach, California (2011).
12. Robertson BD, **Sawicki GS** "Controlling compliance: Feed-forward stimulation pattern influences elastic tuning during cyclic muscle-tendon contractions". 35th Annual Meeting of the American Society of Biomechanics, August 10-13, Long Beach, California (2011).
11. Matta P, Myers J, **Sawicki GS** "The influence of ball mass on youth baseball injury potential: A simulation study". 35th Annual Meeting of the American Society of Biomechanics, August 10-13, Long Beach, California (2011).

10. Farris DJ, **Sawicki GS** "Force-velocity behaviour of human medial gastrocnemius shifts at the walk to run transition". 35th Annual Meeting of the American Society of Biomechanics, August 10-13, Long Beach, California (2011).
9. Farris DJ, Sawicki GS "The mechanics and energetics of human walking and running: A joint-level perspective". 35th Annual Meeting of the American Society of Biomechanics, August 10-13, Long Beach, California (2011).
8. Farris DJ, **Sawicki GS** "Spring-loaded ankle exoskeletons reduce metabolic cost and alter gastrocnemius fascicle behaviour in human hopping". 34th Annual Meeting of the American Society of Biomechanics, August 18-21, Providence, Rhode Island (2010).
7. Wiggin MB, Collins SH, **Sawicki GS** "A passive-elastic ankle exoskeleton using controlled energy storage and release". 34th Annual Meeting of the American Society of Biomechanics, August 18-21, Providence, Rhode Island (2010).
6. &Sheppard P, **Sawicki GS**, Roberts TJ "Power augmentation in a compliant muscle-tendon system". 33rd Annual Meeting of the American Society of Biomechanics, August 26-29, State College, Pennsylvania (2009).
5. Domingo A, **Sawicki GS**, Ferris DP, "Comparison of muscle activity and kinematics during treadmill walking with and without manual assistance in individuals with incomplete spinal cord injury". Fifth World Congress of Biomechanics, July 29-August 4, Munich, Germany (2006).
4. Gordon KE, **Sawicki GS**, Ferris DP, "Mechanical performance of artificial pneumatic muscles to power an ankle-foot orthosis". XXth Congress of the International Society of Biomechanics and 29th Annual Meeting of the American Society of Biomechanics, August 1-5, Cleveland, Ohio (2005).
3. Domingo A, **Sawicki GS**, Ferris DP, "Muscle activation during manually assisted treadmill training after incomplete spinal cord injury". XXth Congress of the International Society of Biomechanics and 29th Annual Meeting of the American Society of Biomechanics, August 1-5, Cleveland, Ohio (2005).
2. **Sawicki GS**, Benkoe G, Wantia J, Erb, P, "Coupled motivations for power, affiliation, and achievement: Modeling resource allocation dynamics in social organizations". XXth Proceedings of the Santa Fe Institute Complex Systems Summer School, (2004).
1. **Sawicki GS**, "Do we walk at the 'edge of chaos'?": Complexity in neuromechanical systems". XXth Proceedings of the Santa Fe Institute Complex Systems Summer School, (2004).

&Indicates co-author that is/was an undergraduate advisee

Teaching Experience

North Carolina State University and University of North Carolina Chapel Hill, Joint Dept. of Biomedical Engineering

- Fall 2016**, BME 590/ISE 589 -Introduction to Rehabilitation Engineering (24 students)
- Fall 2015**, BME 201 -Computer Methods in Biomedical Engineering (53 students)
- Spring 2015**, BME 590/ISE 589 -Introduction to Rehabilitation Engineering (16 students)
- Fall 2014**, BME 201 -Computer Methods in Biomedical Engineering (62 students)
- Spring 2014**, BME 590/ISE 589 -Introduction to Rehabilitation Engineering (12 students)
- Fall 2013**, BME 201 -Computer Methods in Biomedical Engineering (54 students)
- Spring 2013**, BME 590/ISE 589 -Introduction to Rehabilitation Engineering I (10 students)

Fall 2012, BME 201 -Computer Methods in Biomedical Engineering (50 students)
Spring 2012, BME 201 -Computer Methods in Biomedical Engineering (19 students)
Spring 2011, BME 201 -Computer Methods in Biomedical Engineering (25 students)

Spring 2016, Fall 2015, Guest Lecture: NCSU MAE 589, "Human Movement Energetics"
(Instructor: K. Saul)

Spring 2016, 2015, Guest Lecture: UNC-CH HMSC 710, "Muscle-tendon Mechanics" (Instructor:
M. Lewek)

Spring 2014, Faculty Mentor (w/ Jesse Jur et al.), ASSIST senior design team: A Textiles and ECE
collaboration. "A wireless, wearable ankle sensor for estimating locomotion speed, step
frequency, step length and step width in the real-world".

Spring 2016, 2014, Guest Lecture: Duke University, Dept. of Biology, Comparative Physiology,
"Muscle-tendon Mechanics" (Instructor: S. Patek)

Fall 2010, North Carolina State University Educational Training Funds (ETF); "Bio-robotics in the
classroom: An EMG controlled pneumatic muscle-tendon system". Obtained 22,000\$ to develop a
demonstration of proportional myoelectric controlled pneumatic muscles for classroom and public
lectures.

Spring 2010, Guest Lecture: UNC-CH Physical Therapy Seminar (Instructor: M. Lewek)

Fall 2009, Guest Lecture: BME 400 Graduate Seminar (Instructor: Steve Quint)

University of Michigan-Ann Arbor, Dept. of Movement Science

Winter 2004, MVS 330: Movement Science Biomechanics Laboratory (30 students).

UC Davis, Dept. of Mechanical and Aeronautical Engineering

Fall 1999 - Spring 2001, Numerical Methods and Engineering Analysis (x 1), Analysis, Simulation
and Design of Dynamic Systems (x 1), Machining (x 1), Computer-Aided Design (x 2), Heat
Transfer (x 2), Engineering Design (x 1).

Honors/Awards/Fellowships

2013 Elected to NC State University Faculty Scholars (= \$10,000/yr for 5 years for research endeavors)

2013-2017 NIH Clinical Loan Repayment Program (LRP) Award

2013 NIH TIGRR (Training in Grant Writing in Rehabilitation Research) Fellow

2011 North Carolina State University Nominee for David and Lucille Packard Foundation Fellowship in
Science and Engineering

2008-2011 National Institutes of Health (NIH) National Research Service Award for
Postdoctoral Training *terminated in 2009 to take faculty position

2007 Runner-up for American Society of Biomechanics Pre-Doctoral Promising Young Scientist Award

2007 University of Michigan Kinesiology Shirley Cooper International Travel Award

2006 Hunsicker Memorial Award for Outstanding Graduate Student in Kinesiology

2005-2006 University of Michigan Rackham Graduate School Pre-Doctoral Fellowship (12-month
stipend)

2003, 2004, 2006, 2007 University of Michigan Kinesiology Travel Award

2003 University of Michigan Harold and Vivian Shapiro Award for Academic Achievement

2003, 2006, 2007 University of Michigan Rackham Graduate School International Travel Award

2003 International Society of Biomechanics Travel Award - XIXth Congress of the International Society
of Biomechanics, Dunedin, NZ

2003 University of Michigan Kinesiology Summer Fellowship

1999-2001 University of California, Davis Mechanical and Aeronautical Engineering Departmental
Fellowship

1996-1999 Cornell University Mu Sigma Tau Engineering Co-op Member

1994 Eagle Scout - Boy Scouts of America

News and Publicity

PoWeR Lab:

- 09/1/17** Featured in the book “Balance: A Dizzying Journey through the Science of Our Most Delicate Sense” by Carol Svec, Chicago Review Press.
- 10/06/2015** CBS News North Carolina (WNCN) [Video Link](#).
- 09/19/2015** Xploration Station ‘Earth 2050’; [Video Link](#). See the 2nd segment, minute 5+.
- 05/10/2015** Raleigh/Charlotte News and Observer [Article Link](#).
- 01/15/2013** NC State Engineering Alumni Magazine. “Rising Stars”
- 10/15/2012** NC State Engineering Results Magazine.
- 08/30/2012** NC State Football Halftime National TV Advertisement.
- 08/30/2012** Featured in ASEE Video on NCSU Engineering.
- 04/30/2012** Raleigh News and Observer/ Charlotte Observer Science&Technology Section.
- 04/15/2012** NC State Engineering Alumni Magazine.
- 10/17/2011** WRAL News 14, Local, Raleigh-Durham-Chapel Hill North Carolina.
- 07/12/2011** ABCNews11 Local, Raleigh-Durham-Chapel Hill North Carolina.

Journal Publications:

- 30.** Collins SH, Wiggin MB, Sawicki GS, *Nature* (2015).
New York Times, Washington Post, CBC, The Daily Telegraph (UK), The Guardian (UK), BBC, NPR Science Friday, Discovery, Outside Magazine, Popular Mechanics, Scientific American, Popular Science, Science Magazine, Der Spiegel (German), AFP Paris (French), The Australian, De Volkskrant (Dutch), Correio Braziliense, Medicine Today (Swedish), El Pais (Spanish), Japan Today, and many others. [Video Link](#).
- 14.** Farris DJ, Sawicki GS, *PNAS* (2012).
NC State Homepage; Men’s Health Magazine and many others
- 13.** Farris DJ, Sawicki GS, *J Roy Soc Interface* (2011).
NC State Homepage; NC State Technician, NC State Alumni Magazine, O&P.com, Fitness Magazine and others
- 8.** Sawicki GS, Ferris DP, *J Exp Biol* (2008).
University of Michigan Press; MSNBC; Science Daily and others
- 1.** Sawicki GS, Hubbard M, Stronge WJ, *Am J Phys* (2003).
Discovery Channel Canada; National Public Radio; Science Magazine; UC Davis Magazine; USA Today; American Museum of Natural History and others

*Numbering indicates relevant publication from above.

Professional Society Memberships

(ASB) American Society of Biomechanics
(ASME) American Society of Mechanical Engineers
(ASEE) American Society for Engineering Education
(BADER) Bridging Advanced Developments for Exceptional Rehabilitation Consortium
(ISB) International Society of Biomechanics
(SEB) Society of Experimental Biology
(SfN) Society for Neuroscience

(SICB) Society for Integrative and Comparative Biology
(WeaRA) Wearable Robotics Association

Academic Service/Outreach

Departmental Service:

NC State/UNC-CH Joint Dept. Biomed. Eng.:

- 2016** Review Committee Member - NCSU Faculty Scholars
- 2015-2017** Associate Director - Rehabilitation Engineering Core
- 2015-2017** Board Member - Park Scholarship Advisory Committee
- 2015-2017** Faculty Liaison- BME Club - Raleigh Group
- 2015** Chair- BME Departmental Research Retreat
- 2015** Committee Member- BME Undergraduate Program Strategic Planning
- 2014-2015** Committee Member- BME Undergraduate Affairs
- 2013** Initiated bi-weekly Joint Lab Research Meetings with Sawicki, Huang, Cole, Saul, Loba and Fisher Groups
- 2013, 2014** Committee Member - BME Departmental Research Retreat
- 2012** Organizer - BME 'Fall IN' Networking Event
- 2012, 2013, 2014, 2015** Committee Member- Rehabilitation Engineering Center Junior Faculty Search
- 2012-2015** Chair - Abrams Scholarship Program
- 2012-2015** Committee Member- Graduate Admissions Steering/Improvements
- 2012, 2013, 2014, 2015** Committee Member- 'Engineering a World Class Rehabilitation Center' Symposium Planning
- 2012** Organizer- BME Departmental Research Retreat- Rehabilitation Engineering Breakout Session
- 2011** Proposal Developer- Chancellors Faculty Excellence Program (with David Lalush)
- 2011-2015** Committee Member- Rehabilitation Engineering Core Steering (with Helen Huang, Mike Lewek, Rick Wysk; formerly Rick Segal and Rick Wysk); included Bi-Monthly Seminar organizing; REC Pilot Grant Proposal reviews; Affiliated Faculty Database development
- 2009-2015** Committee Member- Rehabilitation Center Director Search
- 2009-2012** Committee Member- BME Graduate Admissions

Brown University Dept. Ecol. Evol. Biol.:

- 2008-2009** Coordinator- Brown Morphology Group Seminar Series

University of Michigan-Ann Arbor Center for the Study of Complex Systems:

- 2005-2006** Coordinator- Complex Systems Advanced Academic Workshop (CSAAW)

Professional/Academic Society Service:

- 2017** Program Committee Member (under Steve Piazza- Penn State), 41th Annual Meeting of the American Society of Biomechanics (ASB); Boulder, CO, August 8-11, 2017.
- 2016-pres.** Opportunities Committee Member, Wearable Robotics Association (WeaRA)
- 2016** Co-Chair/Host (w Kate Saul - MAE), 40th Annual Meeting of the American Society of Biomechanics (ASB); Downtown Raleigh, NC, August 2-5, 2016. Helped obtain NIH R13 grant funding (~20k\$) to run Outreach Expo (~200 attendees at Hunt Library) and organized campus tours on August 2nd to open the meeting.
- 2015** Session Chair, Rehabilitation Engineering, 25th Annual Meeting of Biomedical Engineering Society (BMES);
- 2015** Session Organizer and Chair, Thematic Posters on Exoskeleton and Orthosis Prescription, 39th Annual Meeting of American Society of Biomechanics (ASB);

2015 Abstract Reviewer, 39th Annual Meeting of American Society of Biomechanics (ASB);
2014 Invited Attendee; Roundtable Discussions on Human Augmentation Technology; US Army Natick Soldier RD&E Center; Lowell, MA; Dec. 10-12 2014
2014-pres. Co-Chair (w Sheila Patek, Duke Biology and William Kier, UNC Biology), Physical Biology of Organisms (PBO) Research Network; gathers Triangle area researchers interested in the intersection of Biology and Physics with a focus on locomotion systems.
2014 Abstract Reviewer, 7th World Congress of Biomechanics (WCB);
2014 Panel Organizer/Chair (Lower-limb Exoskeletons); 7th World Congress of Biomechanics (WCB); Coordinated 9 invited speakers.
2013 Session co-Chair (Energetics); American Society of Biomechanics (ASB) Annual Meeting
2012-2013 Invited Attendee; Principal Investigators Quarterly Meetings; DARPA WarriorWeb Program
2012 Session Chair (Gait Methods); American Society of Biomechanics (ASB) Annual Meeting
2012 Co-Organizer; Dynamic Walking Annual Meeting, May 20-24, Pensacola, FL; ~150 attendees, single track of talks/posters, hardware demos and tutorials @ <http://dynamicwalking.org/dw2012/>
2011 Proceedings Manuscript Reviewer; International Conference on Rehabilitation Robotics (ICORR)
2010 Abstract Reviewer, Session Chair (Muscle); American Society of Biomechanics (ASB) Annual Meeting
2010 Session Chair (Muscle Mechanics); Society of Integrative and Comparative Biology (SICB) Annual Meeting
2009 Judge for Best Student Presentation Award; Society of Integrative and Comparative Biology (SICB) Annual Meeting

Tenure Case Reviewer

2016 Ben Gurion University of the Negev, Israel
2015 Medical University of South Carolina

Ad hoc Journal Reviewer (37 Journals):

Applied Bionics and Biomechanics
 ASME Journal of Biomechanical Engineering
 Bionics and Biomechanics
 Bioinspiration and Biomimetics
 Clinical Biomechanics
 Computer Methods in Biomechanics and Biomedical Engineering
 Exercise and Sport Sciences Reviews
 Experimental Brain Research
 Frontiers in Physiology
 Gait and Posture
 Human Movement Science
 Mechatronics
 IEEE Transactions on Biomedical Engineering
 IEEE Transactions on Human-Machine Systems
 IEEE Transactions on Mechatronics
 IEEE Transactions on Neural Systems and Rehabilitation Engineering
 IEEE Transactions on Robotics
 Integrative and Comparative Biology
 International Journal of Robotics and Automation
 Journal of Applied Biomechanics
 Journal of Applied Physiology
 Journal of Experimental Biology

Journal of Biomechanics
Journal of Neurophysiology
Journal of Neuroengineering and Rehabilitation
Journal of Spinal Cord Medicine
Journal of Theoretical Biology
PeerJ
PLoS Computational Biology
PLoS One
Proceedings of the Royal Society - Biological Sciences
Proceedings of the Royal Society Interface
Robotica
Science
Science Robotics
Science Translational Medicine
Spinal Cord Medicine

Grant Reviewer (7 Panels):

Spring 2014 - National Science Foundation (NSF); National Robotics Initiative (NRI) Review Panel (Program Officer: Ted Conway)
Winter 2014 - National Institutes of Health (NIH); Musculoskeletal Rehabilitation Sciences (MRS) R01/03/21/43 Study Section - Mail Reviewer (Program Officer: Jo Pelham)
Summer 2012 - National Institutes of Health (NIH); MOSS; Musculoskeletal Rehabilitation Sciences (MRS) R01/03/21/43 Study Section (Program Officer: Jo Pelham)
Spring 2011 - Joint Agency (NIH/NSF); Robotics SBIR Study Section (Program Officer: James Li)
Spring 2011 - National Institutes of Health (NIH); MOSS; Musculoskeletal Rehabilitation Sciences (MRS) R43 Study Section (Program Officer: Jo Pelham)
Spring 2010 - National Science Foundation (NSF), RAPD II Study Section (Program Officer: Ted Conway)
Spring 2010 - National Institutes of Health (NIH); MTE Study Section (Program Officer: Jean Sipe)

Outreach (29 events since 2010)

4/2017 National Biomechanics Day; Participated as a laboratory demonstration site for the 2nd annual National Biomechanics Day. 50+ middle schoolers participated in demos including hi-speed motion capture, ultrasound imaging and ankle exoskeleton locomotion. April 6, 2017.

2/2017 Stroke Support Group at Sanford, NC Community Enrichment Center- Presented with colleague Derek Kamper, PhD on lower and upper limb robotics for improving movement post-stroke to an audience of ~15 stroke survivors. February 9, 2017.

10/2016 Science Friday - "Better, Stronger, Faster" - The Six Million Dollar Man; Participated as a guest speaker and presented a laboratory demonstration of a EMG controlled pneumatic exoskeleton along with students at the North Carolina Museum of Natral Sciences. ~100+ people attended the talk, demo and movie showing. [Link](#) October 28, 2017.

4/2016 National Biomechanics Day; Participated as a laboratory demonstration site for the first ever National Biomechanics Day. About 40 middle schoolers participated in demos including hi-speed motion capture, ultrasound imaging and a controlling an artificial pneumatic muscle. April 7, 2016.

3/2016 Atlanta Science Festival, Science of the Circus; Participated as a 'science clown' alongside acrobats from the local Imperial Opa circus to explain and demonstrate simple physics/biomechanics principles like balance, angular momentum, conservation of energy, centrifugal/centripetal force, and torque. March 20, 2016.

- 12/2015** 'Cracking the Code'- Masters in Mechanics: The Science of Speed !; Filmed a segment for the monthly series focused on understanding the fundamental biomechanics behind world-class speed guitar technique. [Video Link](#). December 7, 2015.
- 9/2015** Xploration Station 'Earth 2050'; Filmed a segment focusing on our exoskeleton work for this STEM focused 'E/I' ('Education/Information') show that appears nationally on the Fox Network in 80% of households on Saturday mornings. [Video Link](#). See the 2nd segment, minute 5+. First aired on September 19, 2015.
- 7/2015** North Carolina State University High School Summer Camp Program/ NSF REU Lab Demonstrations; Organized a 1 hour laboratory experience for ~15 talented local high school and college students. Exercises included building artificial muscles, acquiring electromyography and programming a real-time proportional myoelectric robot arm. July 9 & July 16, 2015.
- 4/2015** NC State Office of Postdoctoral Affairs Professional Development Workshop; Invited Panelist - Provided advice and feedback on academic life including job search , running a lab, work-life balance and other topics to ~30 NCU post docs. NC State University, Raleigh, NC; March 31, 2015.
- 4/2015** NC BME Annual Symposium; Invited Panelist - Provided advice and feedback on biomechanics research in academia and industry to ~50 undergraduate and graduate students from North Carolina. Duke University, Durham, NC; March 28, 2015.
- 10/2014** Classical Conversations Homeschool Co-op Group of Durham, NC; Organized a ½ day 'field-trip' laboratory experience for ~10 elementary/middle school students (third-eight graders) to design a prototype of a prosthetic limb and use their scientific understandings to write about their work. Exercises included building artificial muscles, acquiring electromyography and programming a real-time proportional myoelectric robot arm to provide students with a real-world context for their learning and a better understanding of how science can be used to help others and make the world a better place. October 10, 2014.
- 7/2014** North Carolina State University High School Summer Camp Program/ NSF REU Lab Demonstrations; Organized a 1/2 day laboratory experience for ~15 talented local high school and college students. Exercises included building artificial muscles, acquiring electromyography and programming a real-time proportional myoelectric robot arm. June 25 & July 23, 2014.
- 3/2014** North Carolina Academy of Science (NCAS) Annual Meeting Special Session - Our lab will present a talk and demonstration called: "Physiology of Wearable Robots" to an audience of >100 scientists and students. [Link](#). March 29, 2014.
- 3/2014** Open Minds: Teen Science Cafe - Held monthly (First Fridays) at the North Carolina Museum of Natural Sciences; Our lab presented a talk and demonstration called: "Bio-inspired Wearable Robots" to an audience of teen scientists. [Link](#). March 7, 2014.
- 7/2013** North Carolina State University High School Summer Camp Program/ NSF REU Lab Demonstrations; Organized a 1/2 day laboratory experience for ~15 talented local high school and college students. Exercises included building artificial muscles, acquiring electromyography and programming a real-time proportional myoelectric robot arm. July 9, 2013.
- 6/2013** 'Live at Nine'; Appeared with lab members on a 1 hr. local cable television show in Sanford , NC. Demonstrated a myoelectrically controlled robotic ankle exoskeleton and clutch- based elastic ankle exoskeletons and discussed rehabilitation applications. June 4, 2013.

- 4/2013** 'UNC Science Expo; Demonstrated a myoelectrically controlled robotic ankle exoskeleton to a general audience of students and their parents on Franklin St. in Chapel Hill. April 13, 2013.
- 4/2013** 'BEST Fest (Biotechnology, Engineering, Science and Technology) - Sponsored by NC Museum of Natural Sciences; Demonstrated a myoelectrically controlled robotic ankle exoskeleton to a general audience of students and their parents. April 6, 2013.
- 1/2013** The Daily Planet Science Cafe – Held weekly at the North Carolina Museum of Natural Sciences; Presented a talk and demonstration called: "Wearable Robotics" to a general audience ~150 attendees. January 10, 2013. [Video Link.](#)
- 9/2012** 'Heroes and Villains and Special Effects' - Sponsored by Durham Museum of Life and Sciences; Demonstrated a myoelectrically controlled robotic ankle exoskeleton to a general audience of students and their parents along with a talk about special effects in the movie 'Iron Man'. September 22, 2012.
- 8/2012** Raleigh/Durham FIRST LEGO League (FLL) - Demonstrated a myoelectrically controlled robotic ankle exoskeleton to a group of local middle school students and their parents who were participating in FIRST robotics healthcare competition. August 27, 2012.
- 8/2012** Stroke Support Group at Sanford, NC Community Enrichment Center- Presented a talk "Biologically Inspired Wearable Robotics for Improving Mobility Post-Stroke" to an audience of stroke survivors and staff therapists (~25 attendees). August 9, 2012.
- 4/2012** Robot Rumble- Sponsored by Durham Museum of Life and Sciences; Demonstrated a myoelectrically controlled robotic ankle exoskeleton to a general audience of students and their parents. April 14, 2012.
- 4/2012** Periodic Tables, Durham's Science Cafe-Sponsored by Durham Museum of Life and Sciences and held monthly at the Broad St. Cafe; Presented a talk and demonstration called: "Human PoWeR: Physiology of Wearable Robotics" to a general audience (~75 attendees). April 10, 2012.
- 10/2011** Stroke Support Group at UNC Meadowmont- Presented a talk "Biologically Inspired Wearable Robotics for Improving Mobility Post-Stroke" to an audience of stroke survivors and staff therapists (~20 attendees). October 12, 2011.
- 10/2011** Science Saturday Lecture Series- Sponsored by a North Carolina Space Grant and held weekly at the North Carolina Museum of Natural Sciences; Presented a talk and demonstration called: "Human PoWeR: Physiology of Wearable Robotics" to a general audience of students and their parents (~40 attendees). October 1, 2011.
- 6/2011** North Carolina State University High School Summer Camp Program; Organized two 1/2 day laboratory experiences for ~120 talented local high school students. Exercises included building artificial muscles, acquiring electromyography and programming a real-time proportional myoelectric robot arm (~20 attendees per session). June 12 and 26, 2011.
- 4/2011** FIRST Robotics Open House; Participated in laboratory open house for local FIRST Robotics students and their parents. Demos included the ZeroG bodyweight support system and a myoelectrically controlled robotic ankle exoskeleton (~15 attendees). April 8, 2011.
- 6/2010-pres.** NSF Innovative Technology Experiences for Students (ITEST) "Scaling up STEM"; Aided high school math instructors from Greene County, NC in planning locomotion biomechanics, robotics and prosthetics related case studies for classroom lessons.

Mentoring Experience

Post Doctoral Scholars (3 mentees in permanent positions, *1 mentee currently in lab)

***Taylor Dick** (Fall 2016-pres.); Ph.D. 2016, Simon Fraser University;

Tracy Norman Giest (Fall 2015-Winter 2016); Ph.D. 2015, Georgia Institute of Technology; will become Director of Biomechanics Research at Fitbit Inc. in San Francisco, CA

Kota Takahashi (Fall 2012-Summer 2015); Ph.D. 2012, University of Delaware; Winner 2013 NCSU Postdoctoral Professional Development Award; currently tenure-track Assistant Professor in the Center for Research in Human Movement Variability at the University of Nebraska-Omaha

Dominic J. Farris (Winter 2010-Fall 2012); Ph.D. 2009, University of Bath, UK; Visiting Scholar at Stanford University National Center for Simulation in Rehabilitation Research (NCSRR) Summer 2012; currently Research Officer at University of Queensland, Brisbane, Australia and scientific advisor to the Australian Institute of Sport

Doctoral Students (2 mentees graduated, *4 mentees currently in lab)

***Laksh Punith** (Fall 2016-pres.); BME, NC State;

***Sasha Philius** (Fall 2015-pres.); BME, NC State;

***Jonathan Doering** (Fall 2014-pres.); BME, NC State;

***Richard Nuckols** (Fall 2013-pres.); BME, NC State;

Michael Bruce Wiggan (Fall 2009-Summer 2014); BME, NC State; ASB President's Best Poster Award Winner 2012; currently a Design Engineer at TransEnterix Inc., a surgical robotics start-up in Raleigh, NC

Benjamin Robertson (Winter 2011-Summer 2014); BME, NC State; currently Post Doc at Temple University with Dr. Andrew Spence

Master's Students (6 mentees graduated, 1 mentee currently in lab)

James McCall (Fall 2016- present) BME, NC State; will start as a PhD student at NC State with Derek Kamper in Fall 2017

Michael Browne (Fall 2013- Spring 2016) BME, NC State; currently a PhD student at UNC Chapel Hill with Jason Franz

Audrey Westbrook (Fall 2013- Fall 2014) BME, NC State; currently Lead Research Engineer for Motion Analysis Lab at High Point University, NC

Nabil Khan (Fall 2011- Summer 2013) BME, UNC Chapel Hill; currently a software engineer at start up company in Research Triangle Park, NC

Caitlin Mahon (Spring 2012- Spring 2013); BME, UNC Chapel Hill; co-Chair with Mike Lewek UNC Physical Therapy; currently a Research Engineer at Walter Reed Army Medical Center, Washington, DC

Austin Hampton (Fall 2010-Summer 2012); BME, NC State; currently a Supervisory Biomedical Engineer at Department of Veterans Affairs in Biloxi, MS

Phil Matta (Fall 2010-Spring 2012); BME, UNC Chapel Hill; NCSU Initiative for Maximizing Student Diversity (IMSD) Fellow; currently a financial analyst at Goldman Sachs in Salt Lake City, UT and the Starling Fellow in Entrepreneurship, UNC Kenan-Flagler School of Business

Undergraduate Students (25 of 36 total at NCSU, \$with guided research, *Abrams Scholar, &NCSU Park Scholar)

§**Emma Pixley** (Fall 2016- Spring 2017); Exercise/Nutrition Sciences, NC State

§***Mark Bartel** (Fall 2015- Spring 2016); BME, NC State

§***Samuel Parker** (Fall 2015- Spring 2016); BME/MechE, NC State

&§**Charlotte DeVoi** (Fall 2015- pres.); BME, NC State

§**Heather Stokes** (Spring 2015- Fall 2015); BME, NC State

§**Seth Steele-Pardue** (Fall 2015- Spring 2016); BME, NC State

§**Sarah Blau** (Summer 2014); Vet School, NC State

\$**William Pfitzner** (Fall 2013- Summer 2014); BME, NC State
 \$**Leighanne Davis** (Fall 2013- Spring 2016); BME, NC State
 \$**William Watts** (Fall 2013- Spring 2014); BME, NC State
 \$**Siddharth Vadakveedu** (Fall 2013- Summer 2015); BME, NC State
 \$**Daniel Harrison** (Fall 2012- Spring 2013) BME, NC State
 \$**Samuel Ray** (Fall 2012- Summer 2014); BME, NC State
 \$**Kyle Vey** (Fall 2012- Summer 2013); BME, NC State
 \$**Arianna Nasser** (Fall 2012- Spring 2016); BME, NC State
 \$**Lexis Schmit** (Summer 2012- Spring 2013); ME, NC State
 \$**Audrey Westbrook** (Summer 2012- Spring 2013); BME/ME, NC State; Enrolled in MS Program in BME at NCSU Fall 2013
 \$**Whitney Barnette** (Fall 2011- Spring 2012); BME, NC State
 \$**Michael Browne** (Summer 2011-Spring 2012); BME, NC State; currently an intern at Precor Strength Inc.; Enrolled in MS Program in BME at NCSU Fall 2013
 \$**Brenton Coburn** (Fall 2011-Spring 2012); BME, NC State; currently a Master's student in NCSU Global Innovation in Management Program.
 \$**Adam Vaden** (Summer 2011-Spring 2013); BME, NC State
Jeremy Schap (Fall 2010-Spring 2013); BME, NC State; attended REU at U. South Carolina (Summer 2011) and REU at U. Pittsburgh (Summer 2012). Currently Biomedical Engineer at Wake Forest University Center for Injury Biomechanics.
 &**Sarah Guess** (Fall 2010-Spring 2012); BME, NC State
 \$**John Miller** (Fall 2009-Spring 2013); BME, NC State; attended REU at U. Pittsburgh (Summer 2011), AG Bell \$10k Scholarship Winner 2012, NSF Graduate Fellow 2013, Will attend University of Virginia, PhD in BME
 &**Steven Mazur** (Fall 2009-Fall 2012); ChemE, NC State
 &**Amber Johnson** (Fall 2009-Fall 2012); BME, NC State

 \$**Gavin Crynes** (Summer 2009); Neuroscience, Brown
 \$**Peter Wellings** (Spring/Summer 2009); ME, MIT
 \$**Peter Sheppard** (Fall 2008-Summer 2009); Biology, Brown

 \$**Evan Pelc** (Summer 2005-Spring 2007); BME, Michigan
 \$**Rebecca Stoloff** (Fall 2004-Spring 2007); ME, Michigan
 \$**Alexis Ball** (Winter 2005); EE, Michigan
 \$**Julie Van Helden** (Fall 2004); BME, Michigan
 \$**Kate Havens** (Fall 2003); BME, Michigan
 \$**Annie Zuzelski** (Spring/Summer 2003); BME, Michigan
 \$**John Green** (Fall 2002); MovSci, Michigan
 \$**Sam Liang** (Fall 2002); EE, Michigan

Graduate Student Committees (not Chair)

Doctoral Students

Jean Sanders (Fall 2016-pres.); Electrical and Computer Engineering, NCSU (Chair: Omer Oralkan);
Michael Browne (Fall 2016-pres.); Biomedical Engineering, UNC Chapel Hill (Chair: Jason Franz);
Stephanie Cone (Spring 2016-pres.); Biomedical Engineering, NC State (Chair: Matthew Fisher);
Nicolas Hanne (Summer 2015-pres.); Biomedical Engineering, NC State (Chair: Jacque Cole);
Ryan Schroeder (Summer 2015-pres.); Biomedical Engineering, U. of Calgary (Chair: John Bertram);
Carolyn Stolfi (Fall 2014-pres.); Biomedical Engineering, NC State (Chair: Jacque Cole);
Michael Rosario (Fall 2014-Fall 2015.); Biology, Duke U. (Chair: Sheila Patek);
Fan Zhang (Spring 2014-Fall 2014); Biomedical Engineering, NC State (Chair: Helen Huang);
James Dieffenderfer (Fall 2013-pres.); Biomedical Engineering, NC State (co-Chair: Alper Bozkurt);

Kamran Shamaei (Spring 2013-Summer 2014); Mechanical Engineering, Yale University, (Chair: Aaron Dollar); currently Post Doc at Stanford University with Alison Okamura
Lauren Putvin (Spring 2013-pres.); Biomedical Engineering, NC State (Chair: C.S. Nam);
Jeremy Greeter (Fall 2010-Spring 2017); Biology, UNC Chapel Hill (Chair: Ty Hedrick);

Master's Students

Michael Poppo (Fall 2016-Spring 2017); Mechanical Engineering, NC State (Chair: Kate Saul);
Kelsey Hennen (Fall 2015-Spring 2016); Biomedical Engineering, NC State (Chair: Kate Saul);
William Boatwright (Fall 2014-Fall 2015); Biomedical Engineering, NC State (Chair: Helen Huang);
Xiatong Li (Spring 2014-Spring 2015); Mechanical Engineering, NC State (Chair: Kate Saul);
Theodore Waltz (Spring 2014-Fall 2016); Biomedical Engineering, Western Carolina University (Chair: Martin Tanaka);
Camille Joy Thompson (Fall 2014-Spring 2016); Biomedical Engineering, NC State (Chair: Ola Harryson);
Ding Wang (Fall 2013-Fall 2014); Biomedical Engineering, NC State (Chair: Helen Huang);

Recent Collaborators (last ~5 years on grant or paper, not as advisee)

Manny Azizi (Ecology and Evolutionary Biology, UC Irvine)
Steven Collins (Mechanical Engineering, Carnegie Mellon University)
Timothy Cope (Applied Physiology, Georgia Institute of Technology)
Nicole Danos (Biology, San Diego University)
Jesse C. Dean (Physical Therapy, Medical University of South Carolina)
Scott Delp (Mechanical Engineering, Stanford U.)
Aaron Dollar (Yale University)
Jason Franz (BME, NCSU)
Michael Gross (Physical Therapy, UNC Chapel Hill)
Helen Huang (BME, NCSU)
Hugh Herr (Mechanical Engineering, Massachusetts Institute of Technology)
Natalie Holt (Biological Sciences, Northern Arizona University)
Michael Lewek (Physical Therapy, UNC Chapel Hill)
Craig McGowan (Biological Sciences, University of Idaho)
Natasha Olby (Vet School, NCSU)
Omer Oralkan (ECE, NCSU)
Sheila Patek (Biology, Duke University)
Stephen Piazza (Kinesiology, Penn State University)
Chris Richards (Royal Veterinary College, UK)
Raziel Riemer (Industrial Engineering, Ben-Gurion University of the Negev, Israel)
Jonas Rubenson (Kinesiology, Penn State University)
Kate Saul (MAE, NCSU)
Massimo Sartori (Biomechanical Engineering, University of Twente, NL)
Andrew Spence (Bioengineering, Temple University)
Gregory Sutton (University of Cambridge, UK)
Kat Steele (Mechanical Engineering, University of Washington)
Conor Walsh (Wyss Institute, Harvard University)
Karl Zelik (Mechanical Engineering, Vanderbilt University)

References

<p>Thomas J. Roberts, Ph.D. (Post Doc Advisor) Professor and Vice Chair Dept. of Ecology and Evolutionary Biology Brown University Box GB205 Providence, RI 02912</p> <p>Phone: (401) 863-3608 E-mail: Thomas_Roberts@brown.edu</p>	<p>Daniel P. Ferris, Ph.D. (Ph.D. Advisor) Professor Dept. of Movement Science Dept. of Biomedical Engineering Dept. of Physical Medicine and Rehabilitation Neuroscience Graduate Group Division of Kinesiology 3152 Observatory Lodge 1402 Washington Heights Ann Arbor, MI 48109-2214</p> <p>Phone: (734) 647-6878 E-mail: ferrisd@umich.edu</p>
<p>Richard R. Neptune, Ph.D. Professor Dept. of Mechanical Engineering University of Texas at Austin Cockrell School of Engineering ETC 4.132 1 University Station, C2200 Austin, TX 78712-0292</p> <p>Phone: (512) 471-0848 E-mail: rneptune@mail.utexas.edu</p>	<p>David Reinkensmeyer, Ph.D. Professor Dept. of Mechanical and Aerospace Engineering Dept. of Biomedical Engineering 4200 Engineering Gateway University of California, Irvine Irvine, CA 92697-3875</p> <p>Phone: (949) 824-5218 E-mail: dreinken@uci.edu</p>
<p>Scott Delp, Ph.D. The James H. Clark Professor Depts. of Bioengineering, Mechanical Engineering, Orthopaedic Surgery Co-Director, Center for Biomedical Computing Stanford University Clark Center, S321 Stanford, CA 94305-3030</p> <p>Phone: (650) 723-1230 E-mail: delp@stanford.edu</p>	<p>Andy Ruina, Ph.D. Professor Dept. of Mechanical Engineering Cornell University 306 Kimball Hall Ithaca, NY 14853</p> <p>Phone: (607) 255-7108 E-mail: ruina@cornell.edu</p>
<p>W. Zev Rymer, M.D., Ph.D. Professor Depts. of Physical Medicine and Rehabilitation and Physiology Rehabilitation Institute of Chicago 345 E Superior, Room 1396 Chicago, IL 60611</p> <p>Phone: (312) 238-3919 E-mail: w-rymer@northwestern.edu</p>	<p>Michael Goldfarb, Ph.D. The H. Fort Flowers Professor Depts. of Mechanical Engineering, Electrical Engineering, Physical Medicine and Rehabilitation Director, Center for Intelligent Mechatronics (CIM) Vanderbilt University 336-C Olin Hall Nashville, TN 37235-1592</p> <p>Phone: (615) 343-6924 E-mail: michael.goldfarb@vanderbilt.edu</p>