



## Scott L. Delp, Ph.D.

James H. Clark Professor in the School of Engineering, Professor of Bioengineering, of Mechanical Engineering and, by courtesy, of Orthopaedic Surgery

 Curriculum Vitae available Online

### CONTACT INFORMATION

#### • Alternate Contact

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### Bio

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#### BIO

Scott Delp is the James H. Clark Professor, Founding Chairman of the Department of Bioengineering at Stanford, and Director of the National Center for Simulation in Rehabilitation Research. Delp transformed the field of biomechanics by creating highly accurate computer models of musculoskeletal structures and providing them to researchers worldwide using a software system (OpenSim) that he and his team developed. Delp invented fundamental technology for surgical navigation that is now in wide clinical use. Together with Mark Schnitzer and their students, Delp developed novel microendoscopes that allow realtime in vivo imaging of human muscle microstructure. Together with Karl Deisseroth and their students, Delp pioneered the use of optogenetics to control activity in the peripheral nervous system leading to important inventions for treating paralysis, spasticity and pain.

#### ACADEMIC APPOINTMENTS

- Professor, Bioengineering
- Professor, Mechanical Engineering
- Professor (By courtesy), Orthopaedic Surgery
- Member, Bio-X
- Member, Child Health Research Institute
- Member, Stanford Neurosciences Institute

#### ADMINISTRATIVE APPOINTMENTS

- Director, Mobilize Center: NIH National Center of Excellence for Big Data in Mobile Health, (2014- present)
- Director, National Center for Simulation in Rehabilitation Research (NCSRR), (2010- present)
- Chairman, Bioengineering Department, (2002-2007)
- Co-Director, NIH Center for Biomedical Computation at Stanford (Simbios), (2001- present)
- Chairman, Biomechanical Engineering Division, (2000-2002)

#### HONORS AND AWARDS

- Member, National Academy of Engineering (2016)

- Giovanni Borelli Award, Am. Soc. Biomech. (2012)
- James H. Clark Professor, Stanford University (2009-)
- Van C. Mow Medal, Am Soc. Mech. Eng (2008)
- Charles Lee Powell Professor, Stanford University (2006-2009)
- Distinguished Alumnus Award, Colorado State University (2005)
- Maurice E Muller Award, Excellence in Computer Assisted Surgery (2004)
- Fellow, American Institute of Biological and Medical Engineers (2003)
- Powell Faculty Scholar, Stanford University (2000)
- Technology Reinvestment Award, White House (1993)
- National Young Investigator Award, NSF (1992-1998)
- Baxter Faculty Fellow, Baxter Foundation (1991)

## PROFESSIONAL EDUCATION

- Ph.D., Stanford University , Mechanical Engineering (1990)
- M.S., Stanford University , Mechanical Engineering (1986)
- B.S., Colorado State University , Mechanical Engineering (1983)

## LINKS

- Neuromuscular Biomechanics Lab: <http://www.stanford.edu/group/nmb/>

## Research & Scholarship

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### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Experimental and computational approaches to study human movement. Development of biomechanical models to analyze muscle function, study movement abnormalities, design new medical products, and guide surgery. Imaging technology development including MRI and microendoscopy. Optogenetic manipulation of peripheral neural circuits. Biomedical technology development.

## Teaching

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### COURSES

#### 2017-18

- Biomechanics of Movement: BIOE 281, ME 281 (Win)
- Modeling and Simulation of Human Movement: BIOE 485, ME 485 (Spr)

#### 2016-17

- Biomechanics of Movement: BIOE 281, ME 281 (Win)
- Modeling and Simulation of Human Movement: BIOE 485, ME 485 (Spr)

#### 2015-16

- Biomechanics of Movement: BIOE 281, ME 281 (Win)

#### 2014-15

- Biomechanics of Movement: BIOE 281, ME 281 (Win)
- Modeling and Simulation of Human Movement: BIOE 485, ME 485 (Spr)

## STANFORD ADVISEES

### Med Scholar Project Advisor

Grace Xiong

### Postdoctoral Faculty Sponsor

Mazen Al Borno, Eni Halilaj, Rachel Jackson, Lukasz Kidzinski, Jessica Selinger

### Doctoral Dissertation Advisor (AC)

Christopher Dembia

### Doctoral (Program)

Peter Dykstra

### Postdoctoral Research Mentor

Eni Halilaj

## GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Bioengineering (Phd Program)
- Neurosciences (Phd Program)

## Publications

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### PUBLICATIONS

- **Muscle-tendon mechanics explain unexpected effects of exoskeleton assistance on metabolic rate during walking.** *journal of experimental biology*  
Jackson, R. W., Dembia, C. L., Delp, S. L., Collins, S. H.  
2017; 220: 2082-2095
- **A Brainstem-Spinal Cord Inhibitory Circuit for Mechanical Pain Modulation by GABA and Enkephalins.** *Neuron*  
François, A., Low, S. A., Sypek, E. I., Christensen, A. J., Sotoudeh, C., Beier, K. T., Ramakrishnan, C., Ritola, K. D., Sharif-Naeini, R., Deisseroth, K., Delp, S. L., Malenka, R. C., Luo, et al  
2017; 93 (4): 822-839 e6
- **Preparatory co-activation of the ankle muscles may prevent ankle inversion injuries.** *Journal of biomechanics*  
Demers, M. S., Hicks, J. L., Delp, S. L.  
2017; 52: 17-23
- **Sanativo Wound Healing Product Does Not Accelerate Reepithelialization in a Mouse Cutaneous Wound Healing Model.** *Plastic and reconstructive surgery*  
Marshall, C. D., Hu, M. S., Leavitt, T., Barnes, L. A., Cheung, A. T., Malhotra, S., Lorenz, H. P., Delp, S. L., Quake, S. R., Longaker, M. T.  
2017; 139 (2): 343-352
- **Biomechanical Effects of an Injury Prevention Program in Preadolescent Female Soccer Athletes** *AMERICAN JOURNAL OF SPORTS MEDICINE*  
Thompson, J. A., Tran, A. A., Gatewood, C. T., Shultz, R., Silder, A., Delp, S. L., Drago, J. L.  
2017; 45 (2): 294-301
- **Human soleus sarcomere lengths measured using in vivo microendoscopy at two ankle flexion angles** *JOURNAL OF BIOMECHANICS*  
Chen, X., Delp, S. L.  
2016; 49 (16): 4164-4167
- **In Vivo Interrogation of Spinal Mechanosensory Circuits.** *Cell reports*  
Christensen, A. J., Iyer, S. M., François, A., Vyas, S., Ramakrishnan, C., Vesuna, S., Deisseroth, K., Scherrer, G., Delp, S. L.  
2016; 17 (6): 1699-1710
- **Biomechanical Effects of an Injury Prevention Program in Preadolescent Female Soccer Athletes.** *American journal of sports medicine*  
Thompson, J. A., Tran, A. A., Gatewood, C. T., Shultz, R., Silder, A., Delp, S. L., Drago, J. L.

2016

- **Gait biomechanics in the era of data science.** *Journal of biomechanics*  
Ferber, R., Osis, S. T., Hicks, J. L., Delp, S. L.  
2016
- **Full-Body Musculoskeletal Model for Muscle-Driven Simulation of Human Gait** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*  
Rajagopal, A., Dembia, C. L., Demers, M. S., Delp, D. D., Hicks, J. L., Delp, S. L.  
2016; 63 (10): 2068-2079
- **Simulating Ideal Assistive Devices to Reduce the Metabolic Cost of Running** *PLOS ONE*  
Uchida, T. K., Seth, A., Pouya, S., Dembia, C. L., Hicks, J. L., Delp, S. L.  
2016; 11 (9)
- **Changes in sarcomere lengths of the human vastus lateralis muscle with knee flexion measured using in vivo microendoscopy** *JOURNAL OF BIOMECHANICS*  
Chen, X., Sanchez, G. N., Schnitzer, M. J., Delp, S. L.  
2016; 49 (13): 2989-2994
- **Beyond the brain: Optogenetic control in the spinal cord and peripheral nervous system** *SCIENCE TRANSLATIONAL MEDICINE*  
Montgomery, K. L., Iyer, S. M., Christensen, A. J., Deisseroth, K., Delp, S. L.  
2016; 8 (337)
- **Simulation-Based Design for Wearable Robotic Systems: An Optimization Framework for Enhancing a Standing Long Jump** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*  
Ong, C. F., Hicks, J. L., Delp, S. L.  
2016; 63 (5): 894-903
- **Evaluation of an Algorithm to Detect the First Ventilatory Threshold from Heart Rate: 2450 June 3, 10: 30 AM - 10: 45 AM.** *Medicine and science in sports and exercise*  
Silder, A., Gold, G. E., Bae, S., Ko, B., Jang, D., Delp, S. L.  
2016; 48 (5): 672-673
- **Optogenetic approaches addressing extracellular modulation of neural excitability** *SCIENTIFIC REPORTS*  
Ferenczi, E. A., Vierock, J., Atsuta-Tsunoda, K., Tsunoda, S. P., Ramakrishnan, C., Gorini, C., Thompson, K., Lee, S. Y., Berndt, A., Perry, C., Minniberger, S., Vogt, A., Mattis, et al  
2016; 6
- **A fast multi-obstacle muscle wrapping method using natural geodesic variations** *MULTIBODY SYSTEM DYNAMICS*  
Scholz, A., Sherman, M., Stavness, I., Delp, S., Kecskemethy, A.  
2016; 36 (2): 195-219
- **Structural foundations of optogenetics: Determinants of channelrhodopsin ion selectivity** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Berndt, A., Lee, S. Y., Wietek, J., Ramakrishnan, C., Steinberg, E. E., Rashid, A. J., Kim, H., Park, S., Santoro, A., Frankland, P. W., Iyer, S. M., Pak, S., Ahrlund-Richter, et al  
2016; 113 (4): 822-829
- **A Biomechanical Model of the Scapulothoracic Joint to Accurately Capture Scapular Kinematics during Shoulder Movements** *PLOS ONE*  
Seth, A., Matias, R., Veloso, A. P., Delp, S. L.  
2016; 11 (1)
- **Optogenetic approaches addressing extracellular modulation of neural excitability.** *Scientific reports*  
Ferenczi, E. A., Vierock, J., Atsuta-Tsunoda, K., Tsunoda, S. P., Ramakrishnan, C., Gorini, C., Thompson, K., Lee, S. Y., Berndt, A., Perry, C., Minniberger, S., Vogt, A., Mattis, et al  
2016; 6: 23947-?
- **Optogenetic and chemogenetic strategies for sustained inhibition of pain.** *Scientific reports*  
Iyer, S. M., Vesuna, S., Ramakrishnan, C., Huynh, K., Young, S., Berndt, A., Lee, S. Y., Gorini, C. J., Deisseroth, K., Delp, S. L.  
2016; 6: 30570-?

- **Stretching Your Energetic Budget: How Tendon Compliance Affects the Metabolic Cost of Running.** *PloS one*  
Uchida, T. K., Hicks, J. L., Dembia, C. L., Delp, S. L.  
2016; 11 (3)
- **In Vivo Imaging of Human Sarcomere Twitch Dynamics in Individual Motor Units** *NEURON*  
Sanchez, G. N., Sinha, S., Liske, H., Chen, X., Viet Nguyen, V., Delp, S. L., Schnitzer, M. J.  
2015; 88 (6): 1109-1120
- **The Role of Cartilage Stress in Patellofemoral Pain** *MEDICINE AND SCIENCE IN SPORTS AND EXERCISE*  
Besier, T. F., Pal, S., Draper, C. E., Fredericson, M., Gold, G. E., Delp, S. L., Beaupre, G. S.  
2015; 47 (11): 2416-2422
- **The mobilize center: an NIH big data to knowledge center to advance human movement research and improve mobility.** *Journal of the American Medical Informatics Association*  
Ku, J. P., Hicks, J. L., Hastie, T., Leskovec, J., Ré, C., Delp, S. L.  
2015; 22 (6): 1120-1125
- **Wirelessly powered, fully internal optogenetics for brain, spinal and peripheral circuits in mice.** *Nature methods*  
Montgomery, K. L., Yeh, A. J., Ho, J. S., Tsao, V., Mohan Iyer, S., Grosenick, L., Ferenczi, E. A., Tanabe, Y., Deisseroth, K., Delp, S. L., Poon, A. S.  
2015; 12 (10): 969-974
- **Self-Tracking Energy Transfer for Neural Stimulation in Untethered Mice** *PHYSICAL REVIEW APPLIED*  
Ho, J. S., Tanabe, Y., Iyer, S. M., Christensen, A. J., Grosenick, L., Deisseroth, K., Delp, S. L., Poon, A. S.  
2015; 4 (2)
- **Muscle velocity and inertial force from phase contrast MRI** *JOURNAL OF MAGNETIC RESONANCE IMAGING*  
Wentland, A. L., McWalter, E. J., Pal, S., Delp, S. L., Gold, G. E.  
2015; 42 (2): 526-532
- **Muscle velocity and inertial force from phase contrast MRI.** *Journal of magnetic resonance imaging*  
Wentland, A. L., McWalter, E. J., Pal, S., Delp, S. L., Gold, G. E.  
2015; 42 (2): spcone-?
- **Musculoskeletal modelling of an ostrich (*Struthio camelus*) pelvic limb: influence of limb orientation on muscular capacity during locomotion** *PEERJ*  
Hutchinson, J. R., Rankin, J., Rubenson, J., Rosenbluth, K. H., Siston, R. A., Delp, S. L.  
2015; 3
- **Making a meaningful impact: modelling simultaneous frictional collisions in spatial multibody systems** *PROCEEDINGS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*  
Uchida, T. K., Sherman, M. A., Delp, S. L.  
2015; 471 (2177)
- **Running with a load increases leg stiffness** *JOURNAL OF BIOMECHANICS*  
Slider, A., Besier, T., Delp, S. L.  
2015; 48 (6): 1003-1008
- **Use it or lose it: multiscale skeletal muscle adaptation to mechanical stimuli.** *Biomechanics and modeling in mechanobiology*  
Wisdom, K. M., Delp, S. L., Kuhl, E.  
2015; 14 (2): 195-215
- **T1 rho Dispersion in Articular Cartilage: Relationship to Material Properties and Macromolecular Content** *CARTILAGE*  
Keenan, K. E., Besier, T. F., Pauly, J. M., Smith, R. L., Delp, S. L., Beaupre, G. S., Gold, G. E.  
2015; 6 (2): 113-122
- **Use it or lose it: multiscale skeletal muscle adaptation to mechanical stimuli.** *Biomechanics and modeling in mechanobiology*  
Wisdom, K. M., Delp, S. L., Kuhl, E.  
2015; 14 (2): 195-215
- **Predictive Simulation Generates Human Adaptations during Loaded and Inclined Walking** *PLOS ONE*  
Dorn, T. W., Wang, J. M., Hicks, J. L., Delp, S. L.

2015; 10 (4)

- **How tibiofemoral alignment and contact locations affect predictions of medial and lateral tibiofemoral contact forces.** *Journal of biomechanics*  
Lerner, Z. F., Demers, M. S., Delp, S. L., Browning, R. C.  
2015; 48 (4): 644-650
- **Is My Model Good Enough? Best Practices for Verification and Validation of Musculoskeletal Models and Simulations of Movement** *JOURNAL OF BIOMECHANICAL ENGINEERING-TRANSACTIONS OF THE ASME*  
Hicks, J. L., Uchida, T. K., Seth, A., Rajagopal, A., Delp, S. L.  
2015; 137 (2)
- **Differences in muscle activity between natural forefoot and rearfoot strikers during running** *JOURNAL OF BIOMECHANICS*  
Yong, J. R., Silder, A., Delp, S. L.  
2014; 47 (15): 3593-3597
- **Are Subject-Specific Musculoskeletal Models Robust to the Uncertainties in Parameter Identification?** *PLOS ONE*  
Valente, G., Pitto, L., Testi, D., Seth, A., Delp, S. L., Stagni, R., Viceconti, M., Taddei, F.  
2014; 9 (11)
- **Musculoskeletal modelling deconstructs the paradoxical effects of elastic ankle exoskeletons on plantar-flexor mechanics and energetics during hopping** *JOURNAL OF EXPERIMENTAL BIOLOGY*  
Farris, D. J., Hicks, J. L., Delp, S. L., Sawicki, G. S.  
2014; 217 (22): 4018-4028
- **3D finite element models of shoulder muscles for computing lines of actions and moment arms** *COMPUTER METHODS IN BIOMECHANICS AND BIOMEDICAL ENGINEERING*  
Webb, J. D., Blemker, S. S., Delp, S. L.  
2014; 17 (8): 829-837
- **Changes in tibiofemoral forces due to variations in muscle activity during walking.** *Journal of orthopaedic research*  
Demers, M. S., Pal, S., Delp, S. L.  
2014; 32 (6): 769-776
- **Quantified self and human movement: A review on the clinical impact of wearable sensing and feedback for gait analysis and intervention** *GAIT & POSTURE*  
Shull, P. B., Jirattigalachote, W., Hunt, M. A., Cutkosky, M. R., Delp, S. L.  
2014; 40 (1): 11-19
- **Neuroscience. Optogenetic regeneration.** *Science*  
Iyer, S. M., Delp, S. L.  
2014; 344 (6179): 44-45
- **Changes in Tibiofemoral Forces due to Variations in Muscle Activity during Walking** *JOURNAL OF NEUROCHEMISTRY*  
DeMers, M. S., Pal, S., Delp, S. L.  
2014; 129 (2): 769-776
- **Virally mediated optogenetic excitation and inhibition of pain in freely moving nontransgenic mice** *NATURE BIOTECHNOLOGY*  
Iyer, S. M., Montgomery, K. L., Towne, C., Lee, S. Y., Ramakrishnan, C., Deisseroth, K., Delp, S. L.  
2014; 32 (3): 274-278
- **Rejuvenation of the muscle stem cell population restores strength to injured aged muscles.** *Nature medicine*  
Cosgrove, B. D., Gilbert, P. M., Porpiglia, E., Mourkioti, F., Lee, S. P., Corbel, S. Y., Llewellyn, M. E., Delp, S. L., Blau, H. M.  
2014; 20 (3): 255-264
- **Improved Muscle Wrapping Algorithms Using Explicit Path-Error Jacobians** *6th International Workshop on Computational Kinematics (CK)*  
Scholz, A., Stavness, I., Sherman, M., Delp, S., Kecskemethy, A.  
SPRINGER-VERLAG BERLIN.2014: 395-403
- **Quantified self and human movement: a review on the clinical impact of wearable sensing and feedback for gait analysis and intervention.** *Gait & posture*  
Shull, P. B., Jirattigalachote, W., Hunt, M. A., Cutkosky, M. R., Delp, S. L.  
2014; 40 (1): 11-19

- **Subject-specific knee joint geometry improves predictions of medial tibiofemoral contact forces** *JOURNAL OF BIOMECHANICS*  
Gerus, P., Sartori, M., Besier, T. F., Fregly, B. J., Delp, S. L., Banks, S. A., Pandy, M. G., D'Lima, D. D., Lloyd, D. G.  
2013; 46 (16): 2778-2786
- **Men and women adopt similar walking mechanics and muscle activation patterns during load carriage.** *Journal of biomechanics*  
Silder, A., Delp, S. L., Besier, T.  
2013; 46 (14): 2522-2528
- **Sarcomere lengths in human extensor carpi radialis brevis measured by microendoscopy** *MUSCLE & NERVE*  
Cromie, M. J., Sanchez, G. N., Schnitzer, M. J., Delp, S. L.  
2013; 48 (2): 286-292
- **WHAT IS A MOMENT ARM? CALCULATING MUSCLE EFFECTIVENESS IN BIOMECHANICAL MODELS USING GENERALIZED COORDINATES.** *Proceedings of the ... ASME Design Engineering Technical Conferences. ASME Design Engineering Technical Conferences*  
Sherman, M. A., Seth, A., Delp, S. L.  
2013; 2013
- **Six-week gait retraining program reduces knee adduction moment, reduces pain, and improves function for individuals with medial compartment knee osteoarthritis.** *Journal of orthopaedic research*  
Shull, P. B., Silder, A., Shultz, R., Dragoo, J. L., Besier, T. F., Delp, S. L., Cutkosky, M. R.  
2013; 31 (7): 1020-1025
- **A rolling constraint reproduces ground reaction forces and moments in dynamic simulations of walking, running, and crouch gait** *JOURNAL OF BIOMECHANICS*  
Hamner, S. R., Seth, A., Steele, K. M., Delp, S. L.  
2013; 46 (10): 1772-1776
- **How muscle fiber lengths and velocities affect muscle force generation as humans walk and run at different speeds.** *journal of experimental biology*  
Arnold, E. M., Hamner, S. R., Seth, A., Millard, M., Delp, S. L.  
2013; 216: 2150-2160
- **Optical inhibition of motor nerve and muscle activity in vivo.** *Muscle & nerve*  
Liske, H., Towne, C., Anikeeva, P., Zhao, S., Feng, G., Deisseroth, K., Delp, S.  
2013; 47 (6): 916-921
- **Muscle contributions to vertical and fore-aft accelerations are altered in subjects with crouch gait.** *Gait & posture*  
Steele, K. M., Seth, A., Hicks, J. L., Schwartz, M. H., Delp, S. L.  
2013; 38 (1): 86-91
- **Stabilisation of walking by intrinsic muscle properties revealed in a three-dimensional muscle-driven simulation** *COMPUTER METHODS IN BIOMECHANICS AND BIOMEDICAL ENGINEERING*  
John, C. T., Anderson, F. C., Higginson, J. S., Delp, S. L.  
2013; 16 (4): 451-462
- **Patellar maltracking is prevalent among patellofemoral pain subjects with patella alta: An upright, weightbearing MRI study** *JOURNAL OF ORTHOPAEDIC RESEARCH*  
Pal, S., Besier, T. F., Beaupre, G. S., Fredericson, M., Delp, S. L., Gold, G. E.  
2013; 31 (3): 448-457
- **Changes in in vivo knee contact forces through gait modification** *JOURNAL OF ORTHOPAEDIC RESEARCH*  
Kinney, A. L., Besier, T. F., Silder, A., Delp, S. L., D'Lima, D. D., Fregly, B. J.  
2013; 31 (3): 434-440
- **Muscle contributions to fore-aft and vertical body mass center accelerations over a range of running speeds** *JOURNAL OF BIOMECHANICS*  
Hamner, S. R., Delp, S. L.  
2013; 46 (4): 780-787
- **Flexing computational muscle: modeling and simulation of musculotendon dynamics.** *Journal of biomechanical engineering*  
Millard, M., Uchida, T., Seth, A., Delp, S. L.  
2013; 135 (2): 021005-?

- **Toe-in gait reduces the first peak knee adduction moment in patients with medial compartment knee osteoarthritis.** *Journal of biomechanics*  
Shull, P. B., Shultz, R., Slider, A., Dragoo, J. L., Besier, T. F., Cutkosky, M. R., Delp, S. L.  
2013; 46 (1): 122-128
- **Toe-in gait reduces the first peak knee adduction moment in patients with medial compartment knee osteoarthritis** *JOURNAL OF BIOMECHANICS*  
Shull, P. B., Shultz, R., Slider, A., Dragoo, J. L., Besier, T. F., Cutkosky, M. R., Delp, S. L.  
2013; 46 (1): 122-128
- **Optogenetic control of targeted peripheral axons in freely moving animals.** *PloS one*  
Towne, C., Montgomery, K. L., Iyer, S. M., Deisseroth, K., Delp, S. L.  
2013; 8 (8)
- **Optical control of neuronal excitation and inhibition using a single opsin protein, ChR2.** *Scientific reports*  
Liske, H., Qian, X., Anikeeva, P., Deisseroth, K., Delp, S.  
2013; 3: 3110-?
- **How much muscle strength is required to walk in a crouch gait?** *JOURNAL OF BIOMECHANICS*  
Steele, K. M., van der Krogt, M. M., Schwartz, M. H., Delp, S. L.  
2012; 45 (15): 2564-2569
- **Comparison of MRI and 18F-NaF PET/CT in patients with patellofemoral pain** *JOURNAL OF MAGNETIC RESONANCE IMAGING*  
Draper, C. E., Quon, A., Fredericson, M., Besier, T. F., Delp, S. L., Beaupre, G. S., Gold, G. E.  
2012; 36 (4): 928-932
- **Contributions of muscles to mediolateral ground reaction force over a range of walking speeds** *JOURNAL OF BIOMECHANICS*  
John, C. T., Seth, A., Schwartz, M. H., Delp, S. L.  
2012; 45 (14): 2438-2443
- **Optimizing Locomotion Controllers Using Biologically-Based Actuators and Objectives** *ACM TRANSACTIONS ON GRAPHICS*  
Wang, J. M., Hamner, S. R., Delp, S. L., Koltun, V.  
2012; 31 (4)
- **Predicting the metabolic cost of incline walking from muscle activity and walking mechanics** *JOURNAL OF BIOMECHANICS*  
Slider, A., Besier, T., Delp, S. L.  
2012; 45 (10): 1842-1849
- **Patellar tilt correlates with vastus lateralis: Vastus medialis activation ratio in maltracking patellofemoral pain patients** *JOURNAL OF ORTHOPAEDIC RESEARCH*  
Pal, S., Besier, T. F., Draper, C. E., Fredericson, M., Gold, G. E., Beaupre, G. S., Delp, S. L.  
2012; 30 (6): 927-933
- **How robust is human gait to muscle weakness?** *GAIT & POSTURE*  
van der Krogt, M. M., Delp, S. L., Schwartz, M. H.  
2012; 36 (1): 113-119
- **Compressive tibiofemoral force during crouch gait** *GAIT & POSTURE*  
Steele, K. M., Demers, M. S., Schwartz, M. H., Delp, S. L.  
2012; 35 (4): 556-560
- **Grand challenge competition to predict in vivo knee loads** *JOURNAL OF ORTHOPAEDIC RESEARCH*  
Fregly, B. J., Besier, T. F., Lloyd, D. G., Delp, S. L., Banks, S. A., Pandy, M. G., D'Lima, D. D.  
2012; 30 (4): 503-513
- **Simbios: an NIH national center for physics-based simulation of biological structures** *JOURNAL OF THE AMERICAN MEDICAL INFORMATICS ASSOCIATION*  
Delp, S. L., Ku, J. P., Pande, V. S., Sherman, M. A., Altman, R. B.  
2012; 19 (2): 186-189
- **Patients with patellofemoral pain exhibit elevated bone metabolic activity at the patellofemoral joint** *JOURNAL OF ORTHOPAEDIC RESEARCH*  
Draper, C. E., Fredericson, M., Gold, G. E., Besier, T. F., Delp, S. L., Beaupre, G. S., Quon, A.



2012; 30 (2): 209-213

- **Characteristics associated with improved knee extension after strength training for individuals with cerebral palsy and crouch gait.** *Journal of pediatric rehabilitation medicine*  
Steele, K. M., Damiano, D. L., Eek, M. N., Unger, M., Delp, S. L.  
2012; 5 (2): 99-106
- **A COMPUTATIONALLY EFFICIENT MUSCLE MODEL** *ASME Summer Bioengineering Conference (SBC)*  
Millard, M., Delp, S.  
AMER SOC MECHANICAL ENGINEERS.2012: 1055–1056
- **EXPERIMENTAL EVALUATION OF COMPUTATIONALLY PREDICTED CHANGES IN KNEE LOADS RESULTING FROM MEDIAL THRUST GAIT** *ASME Summer Bioengineering Conference (SBC)*  
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