

## CURRICULUM VITAE

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**Citizenship:** USA

**Current position:** Provost Associate Professor, University of Southern California Departments of Biomedical Engineering, Neurology, and Biokinesiology.  
Childrens Hospital of Los Angeles, Department of Neurology.

### A. ACADEMIC HISTORY

#### Education:

**1985** A.B. Harvard College Department of Applied Mathematics

**1986** M.S. Harvard University Department of Applied Mathematics

**1993** M.D. Harvard Medical School Division of Health Sciences and Technology

**1993** Ph.D. Massachusetts Institute of Technology Department of Electrical Engineering and Computer Science. Thesis: "Theoretical Elements of Hierarchical Control in Vertebrate Motor Systems"

#### Scholarships and Honors:

**1981** Westinghouse Science Talent Search 6th place winner.

**1985** Highest departmental honors in Applied Mathematics, and *Magna Cum Laude* honors from Harvard College.

**1985** Hoopes Prize for undergraduate thesis.

**1985** National Science Foundation Graduate Fellowship.

**1988** Medical Scientist Training Program Fellowship.

**1990** National Defense Science and Engineering Fellowship.

#### Post-doctoral and Residency Training:

##### Internship and Residencies:

**1993-1994** Intern in Pediatrics, USC/Los Angeles County Medical Center, Los Angeles

**1995** Resident in Pediatrics, USC/Los Angeles County Medical Center, Los Angeles

**1995-1996** Part-time clinical fellow, Children's Hospital Department of Neurology, Boston

**1996-1999** Resident, Children's Hospital Department of Neurology, Boston

**1999-2000** Fellow, Movement Disorders Unit, Toronto Western Hospital, Toronto

### **Post-doctoral Research Fellowships:**

**1993-1995** Research Staff, NASA Jet Propulsion Laboratory, with Jacob Barhen

**1995-1996** Post-doctoral Research Fellow, MIT, with Emilio Bizzi

### **Licensure and Certification:**

**1995** Massachusetts Board of Registration in Medicine

**1995** California Medical Board

**1995** U.S. Drug Enforcement Administration

**1994** Pediatric Advanced Life Support, Los Angeles County Hospital

**1996** Advanced Cardiac Life Support, Massachusetts General Hospital

**1996** Advanced Trauma Life Support, Massachusetts General Hospital

**2000** National Board of Medical Examiners Certification in Neurology with Special Competence in Child Neurology

### **Languages:**

**French:** 5 years study

**Italian:** 3 years study

**Spanish:** 2 years study

**Japanese:** 1 year study

### **Funding:**

#### **Current:**

**R01 HD081346** active NIH/NINDS/NICHHD, 7/1/14-6/30/18, Total direct costs \$2,442,283 “Multi-center trial of Augmented Sensory Feedback in Children with Dyskinetic CP” Role: PI. The major goal of this proposal is to test the efficacy and mechanism of electromyographic biofeedback for improving symptoms of dyskinetic cerebral palsy.

**Investigator-initiated clinical research** active. Carter Foundations, 8/1/01 - continuing, Direct costs \$125,000-\$260,000 per year, renewable, “Working Group on Childhood Motor Disorders.” Role: PI. The major goal of this project is to investigate, in detail, the complete set of motor impairments that lead to disabilities in a small number of children with severe movement disorders.

#### **Pending:**

**R01 NS088468** NIH/NIBIB, 7/1/14-6/30/19, Total direct costs \$2,358,023 “Partnership for development of multi-muscle myocontrol in children with CP” Role: PI. The major goal of this proposal is to develop a software platform to allow effective control of prosthetics and robots from the electromyographic signal in children with cerebral palsy.

## Completed:

- R01 NS069214** completed. NIH/NINDS/NIBIB, 7/1/09-12/30/14, Total direct costs \$875,000, “High-speed simulation of developmental motor disorders.” Role: PI. The major goal of this project is to use high-speed programmable logic devices to simulate the development of long and short-latency reflexes and the evolution of spasticity and dystonia in children with early brain injury.
- Investigator-initiated research** completed. James S. McDonnell Foundation 9/1/09-8/31/13, Total direct costs \$450,000 “High-speed simulation and prediction of the effect of brain injury on development.” Role: PI. The major goal of this project is to create a faster-than-realtime simulation of spinal and cortical circuitry that can be used to predict the effect of early neuronal injury on subsequent motor impairments.
- U13 NS043180** completed. NIH/NINDS/NICHHD, 9/1/02-8/31/10, Direct costs \$65,000 per year, renewable, “NIH task force on childhood motor disorders.” Role: PI. The major goal of this project is to fund ongoing meetings of a task force to provide consensus definitions and propose candidate rating scales for assessment of children with motor disorders.
- R01 NS055039** completed. NIH/NINDS, 7/1/09-4/30/13, Total direct costs \$875,000, “Optimization of Communication devices for children with secondary dystonia.” Role: PI. The major goal of this project is to investigate the relationship between motor performance and the information-theoretic concept of channel capacity in children with secondary dystonia.
- R01 NS052236** completed. NIH/NINDS, 7/15/06-4/15/12, Total direct costs \$1,010,000, “Failure of Motor Learning in Childhood Dystonia.” Role: PI. The major goal of this project is to investigate the sensory and motor mechanisms that prevent children with dystonia from improving their performance through practice.
- Investigator-initiated research** completed. Walker Family Foundation, 1/1/06 - 12/31/08, Total direct costs \$100,000, Indirect costs \$8,000, “Assessment of Childhood Motor Disorders.” Role: PI. The major goal of this project is to perform basic and clinical research on quantification and diagnosis of movement disorders in children.
- Unrestricted Educational Grant** completed. Allergan, Inc., 3/1/2001-continuing, Direct costs \$5,000 per year, renewable “NIH task force on childhood motor disorders.” Role: PI. The major goal of this project is to fund ongoing meetings of a task force to provide consensus definitions and propose candidate rating scales for assessment of children with motor disorders.
- UCP Pilot Grant** completed. United Cerebral Palsy Research and Education Foundation, 8/1/07-7/31/09, Total direct costs \$100,000, “Reflex contributions to abnormal movement in dyskinetic cerebral palsy.” Role: PI. The major goal of this project is to determine the contribution of short-latency and long-latency abnormal reflexes to disturbances of voluntary reaching in children with CP.
- Child Health Research Program Pilot Grant** completed. Lucile Packard Children’s Hospital, 4/1/07-3/31/08, Total direct costs \$30,000, “Advanced Statistical Methods for Biofeedback in Children with Dyskinetic Cerebral Palsy.” Role: PI. The major goal of this project is to perform preliminary clinical testing of a new biofeedback sensor and nonlinear signal processing algorithm that I have developed.

- K23 NS41243** completed. NIH/NINDS, 6/1/01-5/31/06, “Arm kinematics in hyperkinetic cerebral palsy.” Role: PI. The major goal of this project is to determine whether hyperkinetic arm movements are due to noise in the motor system or to a limitation of voluntary movement.
- R13 NS055614** completed. NIH/NINDS, 4/1/06-3/31/07, “Neural Control of Abnormal Movement.” Role: PI. The major goal of this project is to support the organization of a satellite meeting to the Neural Control of Movement society meeting in order to encourage participation of clinicians and clinical investigators and collaboration between clinical and basic science investigators.
- Investigator-initiated clinical research** completed. Elan Pharmaceuticals, Inc., 4/1/02-3/30/05, “Does Myobloc improve functional hand use in young children with a hypertonic upper extremity.” Role: PI. The major goal of this project is to test whether a series of three escalating doses injections of Myobloc in the biceps and brachioradialis of children age 2-6 years old with restriction of arm movement due to increased tone in the arm flexor muscles can improve functional reaching.
- R21 NS045638** completed. NIH/NINDS, 4/1/03-3/31/05, “Childhood motor impairment and assisted communication.” Role: PI. The major goal of this project is to investigate the relationship between measures of upper-extremity motor function and the design of optimal communication interfaces for children with motor disorders.
- Investigator-initiated clinical research** completed. United Cerebral Palsy Foundation, 2/1/02-1/31/05, “Cerebral Hypertonia of Central origin an Open-Label trial of Anticholinergic Treatment Effects.” Role: PI. The major goal of this project is to test whether there is an improvement in upper-extremity function in children with dystonia treated with an escalating dose of oral trihexyphenidyl. This is a multi-center trial performed as lead site of the Childhood Motor Study Group.
- Pfizer Scholars Grant** completed. Pfizer Pharmaceuticals Group, 7/1/01-6/30/02, “A Virtual-reality Training Environment for the Treatment of Pediatric Dystonia.” Role: PI. The major goal of this project is to develop the hardware and software for an interactive environment that can be used to test the ability to retrain arm movements in children with upper extremity dystonia and improve their quality of reaching.

## B. EMPLOYMENT HISTORY

- 1993-1994** Intern in Pediatrics, USC/Los Angeles County Medical Center, Los Angeles.
- 1993-1994** Research Staff, NASA Jet Propulsion Laboratory, Pasadena.
- 1995** Resident in Pediatrics, USC/Los Angeles County Medical Center, Los Angeles.
- 1995-1996** Clinical fellow, Children’s Hospital Department of Neurology, Boston.
- 1995-1996** Postdoctoral Research Assistant, MIT, Boston.
- 1996-1999** Resident, Children’s Hospital Department of Neurology, Boston.
- 1999-2000** Clinical Fellow, Movement Disorders Unit, Toronto Western Hospital.
- 7/1/2000-8/15/2009** Assistant Professor of Child Neurology (UTL), Dept. Neurology and Neurological Sciences, Stanford University.
- 7/1/2000-8/15/2009** Medical Staff, Lucile Packard Children’s Hospital.

**8/16/2009-present** Provost Associate Professor of Biomedical Engineering, Neurology, and Biokinesiology, USC

**8/16/2009-present** Medical Staff, Children's Hospital of Los Angeles.

### **C. PUBLIC AND PROFESSIONAL SERVICE**

#### **Professional groups:**

- Childhood Motor Study Group (CMSG), co-director and principal investigator
- NIH Taskforce on Childhood Motor Disorders, principal investigator
- Child Neurology Society - Movement Disorders Special Interest Group
- Dystonia Medical Research Foundation - Scientific Advisory Board
- Neural Control of Movement Society - Executive Committee, Secretary
- Journal of Motor Behavior - Consulting Editor
- American Institute of Medical and Biological Engineers - Fellow

#### **Consulting:**

- StemCells, Inc. 2002-2008.

#### **Teaching:**

- NENS220, "Computational Neuroscience", co-instructor with John Huguenard
- ME281, "Biomechanics of Movement", co-instructor with Scott Delp, 2002.
- NSADA program for teaching translational research in Child Neurology, co-director
- Psychology 202, invited lecturer
- Neuro 205, invited lecturer
- BioDesign program "Bootcamp" director, 2003-2004
- NENS299 "Computational Neural Networks", 2003
- BioE341 "Computational Neural Networks", 2008
- BME414 "Functional Neuroanatomy of the Motor System", 2012-2013
- BME599 "Nonlinear Filtering", 2015
- resident and medical student teaching

### Meeting Organization:

- 1995 “Neuroscience and Neural Networks”, workshop at Neural Information Processing Systems meeting, co-organizer.
- 1998 “Computational Motor Control”, satellite to NCM meeting. co-organizer.
- 2000 “Computational Motor Control”, satellite to NCM meeting. co-organizer.
- 2000 “Diagnosis of Hypertonia in Children”, symposium, Toronto. co-organizer.
- 2001-2006 “Taskforce on Childhood Motor Disorders”. organizer and PI.
- 2006 “Neural Control of Abnormal Movement”, satellite to NCM meeting. co-organizer.
- 2015 “Large-scale models of brain disease”, workshop at Brain Informatics and Health meeting.

### Peer Review Panels:

1. Musculoskeletal Rehabilitation Study Group (MRS) *ad hoc* 2006
2. Function, Integration, and Rehabilitation Sciences Subcommittee (FIRS) *standing* 2006-2010
3. Child Neurology Foundation *ad hoc* 2004
4. Dystonia Medical Research Foundation *standing* 2005-2008
5. Alternating Hemiplegia of Childhood Foundation *standing* 2009-ongoing

### Editorial Boards:

1. *Movement Disorders* Journal
2. *Human Movement Science* Journal

### Committees and service (Stanford 2000-2009):

1. Neuroscience Institute at Stanford, Director of working group on child motor disorders, 2004-2006.
2. NSADA Planning and Direction, 2003-2006.
3. Cerner Clinical Information System, MD design team, 2004.
4. MD Cerner Advisory Team, 2004.
5. Down Syndrome Clinic planning meetings, 2004.
6. Biodesign Planning Committee, 2000-2001.
7. Neuroscience faculty search committee, 2001.

### Committees and service (USC 2009-ongoing):

1. HTE@USC Academic Director 2009-ongoing.
2. University Research Committee 2013-2015.
3. Childhood Technology Innovation Program research director 2014-ongoing.

### Technical Referee:

## Movement Disorders and Dystonia

1. *Movement Disorders*
2. *J. Neurology, Neurosurgery, Psychiatry*
3. *J. Child Neurology*
4. *Pediatric Neurology*
5. *Neurology*
6. *Lancet Neurology*

## Movement Science and Biomechanics

1. *J. Motor Behavior*
2. *Exp. Brain Research*

## Computational Neuroscience and Neural Networks

1. *Neural Computation*
2. *Neural Networks*
3. *IEEE Transactions on Neural Networks*
4. *IEEE Transactions on Pattern Analysis and Machine Intelligence*
5. *Biological Cybernetics*
6. *Physics Review Letters*

## Neurophysiology and Neuroscience

1. *J. Neurophysiology*
2. *J. Neuroscience*
3. *Brain*
4. *J. Neuroscience Methods*
5. *Neurobiology of Disease*
6. *Brain and Cognition*
7. *Epilepsia*
8. *Nature Neuroscience*
9. *Nature*

**Primary Research Goal:** To understand and prevent adverse effects of childhood brain disorders on motor development.

**Major Research Areas:**

**Computational Neuroscience and Neural Networks:**

1. The mathematical description of dystonia and abnormal human movement
2. Mathematical models of abnormal basal ganglia function
3. Neural Network models of normal and disordered human motor learning
4. Neural Network control algorithms for robotics, and failure of control
5. Factors that enhance or prevent motor learning
6. Contribution of disordered sensory processing to dystonia
7. Information representation in neural population codes
8. Maximum-likelihood methods for interpreting bioelectric signals
9. Nonlinear stochastic control

**Clinical Research in Childhood Movement Disorders:**

1. Tools for quantification and diagnosis of dystonia in children
2. Quantification of ataxia, apraxia, and deficits of selective motor control
3. Role of botulinum toxin in the modification of learned motor patterns
4. Effect of early treatment of dystonia on motor developmental outcome
5. Feedback retraining of multiple-muscle patterned movement
6. Virtual-reality environments for motor retraining
7. Optimization of assisted communication interfaces for children with motor disorders
8. Effect of risk on behavior of children with motor disorders
9. Myoelectrically controlled prosthetics
10. Pneumatic-driven upper extremity exoskeletons for rehabilitation

**D. POST-DEGREE HONORS AND AWARDS**

**Honors And Awards**

**1995** McDonnell-Pew Postdoctoral Fellowship.

**1996-1998** von Meyer Travelling Fellowship.

**2000** Dystonia Medical Research Foundation New Millennium Award.

**2001** Pfizer Faculty Scholars Award.

**2003** United Cerebral Palsy Leaves of Hope Award.

**2003** William M. Hume Faculty Scholar Award.

**2004** Biodesign program teaching award.

**2013** Menkes honorary lectureship.

**2015** AIMBE Fellow

**Selected Invited Papers and Addresses (70):**



1. “New Technology for Assessment and Treatment of Pediatric Motor Disorders”, keynote lecture and keynote public symposium, European Academy of Childhood Disability (EACD), Copenhagen, 2015.
2. “Pediatric Deep-Brain Stimulation Consortium criteria and purpose”, invited lecture, Neurostimulation satellite symposium to the European Pediatric Neurology Society (EPNS), Vienna, 2015.
3. “Pediatric Movement Disorders”, Peking University First Hospital child neurology forum, keynote speaker, 2015.
4. “Recent research in dystonia”, Peking University First Hospital dept. Child Neurology, invited talk, 2015.
5. “Evolving view of dystonia”, Childrens Hospital Los Angeles, grand rounds invited speaker, 2015.
6. “Dyskinetic Cerebral Palsy”, Istituto Eugenio Medea, Milan, invited talk, 2015.
7. “New perspectives on dystonia”, New York University Medical Center, invited talk, 2014.
8. “Stochastic Dynamic Operators”, ATR Japan Telecommunications Research Laboratory, invited talk, 2014.
9. “SDO framework for interpretation of neural population codes for movement”, AREADNE (Research on encoding and decoding of neural ensembles), invited speaker, 2014.
10. “Likelihood Calculus”, ATR Japan Telecommunications Research Laboratory, invited talk, 2013.
11. “High-speed simulation of childhood motor disorders”, Japan Society for Neuroscience, invited lecture, 2013.
12. “Deep-Brain stimulation programming and debugging”, invited talk, CME event 2013.
13. “Likelihood Calculus”, Computational and Systems Neuroscience (Cosyne) conference, invited talk, 2013.
14. “Dystonia in children: Engineering new treatments”, UCLA, invited Menkes annual lecture, 2013.
15. “The Electronic Medical Record”, Keck Hospital Dept. Medicine grand rounds, 2013.
16. “Treating Dystonia”, CHLA Associates meeting, 2013.
17. “Risk”, TEDx Youth Hollywood, 2013.
18. “Stochastic Operator Superposition”, Braincorp, 2012.
19. “Treating Dystonia”, Alternating Hemiplegia of Childhood annual meeting, 2012.
20. “New Perspectives on Dystonia”, “Classification of Motor Disorders in Childhood”, “Diagnosis of Cerebral Palsy”, Australian Academy of Cerebral Palsy and International Child Neurology Society, invited plenary talk and invited seminar talks, 2012.
21. “Risk-aware Control”, Biomedical Engineering Society, 2012.
22. “Diagnosis of childhood motor disorders”, Orange County California Children’s Services, invited lecture, 2012.
23. “Learning with Spikes”, “Estimation and Coding in Networks of Spiking Neurons”, invited and contributed talks, Neural Control of Movement Society, San Juan, 2011.

24. "New Perspectives on Dystonia", "Technology for quantification of movement disorders", invited lectures, European Academy of Childhood Disabilities, Rome, 2011.
25. "Computational Models of Movement Disorders", invited talk, Fondazione Santa Lucia, Rome, 2011.
26. "Movement Disorders Research", USC Global Conference, Hong Kong, 2011.
27. "Dystonic Cerebral Palsy", 3rd Symposium on Paediatric Movement Disorders, invited lecture, Barcelona, 2011.
28. "Diagnosis and Treatment of Movement Disorders in Children", invited lecture and tutorial, Occupational Therapy Association of California, September, 2010.
29. "Classification and Definition of Movement Disorders in Cerebral Palsy", invited keynote lecture and Goldenson award lecture, American Academy of Cerebral Palsy, September 2010.
30. "Stochastic Control of Nonlinear Systems by Populations of Spiking Neurons", invited lecture, Engineering in Medicine and Biology Society, August 2010.
31. "Movement Disorders in Childhood Metabolic Diseases", invited lecture, Movement Disorders Society, June 2010.
32. "Stochastic Control by Neural Populations", invited lecture, Joint Society for Neural Computation, May 2010.
33. "Linear Stochastic Operators for Control", invited lecture, Dept. Electrical Engineering, USC, January 2010.
34. "Definition and Classification of Movement Disorders in Children", invited Grand Rounds speaker, Childrens Hospital of Los Angeles, January 2010.
35. "Controlling Noise", invited lecture at Cambridge University Dept. Engineering, July 2009.
36. "Abnormal Reflexes in Childhood Hypertonic Dystonia", invited lecture at Queen Square Institute of Neurology, July 2009.
37. "Diagnosis of Hyperkinetic Disorders in Childhood", invited lecture, Great Ormond Street Hospital, July 2009.
38. "Failure and Success of Motor Learning", invited keynote speaker at the Snowbird Machine Learning Conference, April 2009.
39. "Dystonia, Spasticity, and the Anatomy of Abnormal Reflexes", invited keynote speaker at the Gait and Clinical Motion Analysis Society, March 2009.
40. "The Anatomy of Childhood Hypertonic Dystonia", invited grand rounds at the Massachusetts General Hospital "Etherdome", February 2009.
41. "Failure of Motor Learning," invited lecture at MIT, May 2007.
42. "Pediatric Movement Disorders," invited lecture at the Movement Disorder Society, October 2006.
43. "New perspectives on pediatric dystonia", invited lecture, UCLA, March 2006.
44. "Diagnostic and Assessment measures of Ataxia-Telangiectasia", invited lecture at an NINDS-sponsored ataxia-telangiectasia clinical research workshop, March 2006.
45. "Movement disorders in degenerative and storage diseases", invited lecture at the Neurotrophic factors workshop of Children's Neurobiological Solutions, March 2006.

46. "Dystonia in children with cerebral palsy", invited lecture at the Rehabilitation Institute of Chicago, October 2005.
47. "Medication and Rehabilitation", invited lecture at the Dystonia Medical Research Foundation research meeting, September 2005.
48. "Dystonia, spasticity, and rigidity", invited lecture at U. Pittsburgh Medical Center, August 2005.
49. "Dystonia, spasticity, and rigidity", invited lecture at the Rehabilitation Institute of Chicago, August 2005.
50. "Dystonia, hypertonia, and co-contraction in children: It's not what we think", invited lecture at Northwestern University, August 2005.
51. "Pediatric Movement Disorders," invited lecturer at the Movement Disorder Society, March 2005.
52. "Movement disorders in cerebral palsy," invited lecturer at the American Academy of Neurology, April 2005.
53. "Failure of motor learning", invited lecture at the Redwood Neuroscience Institute, January 2005.
54. "US Taskforce on childhood motor disorders", invited lecture at the SPASM conference, Newcastle-on-Tyne, December 2004.
55. "Dystonia, spasticity, and rigidity - why are they important in cerebral palsy and how do we measure them?" course director and lecturer at the American Academy of Cerebral Palsy and Developmental Medicine, September 2004.
56. "New insights into the etiology of cerebral palsy", invited lecture at the American Academy of Pediatrics, October 2004.
57. "Tics, twitches, and Tourette syndrome", invited lecture at the American Academy of Pediatrics, October 2004.
58. "Acquired/Secondary movement disorders in childhood", invited lecture at the Movement Disorders Society, June 2004.
59. "Stiffness, spasticity, and dystonia: diagnosis and management of hypertonia in children", Brown University invited lecture, May 2004.
60. "Tools used to measure rigidity", invited lecture at the Kinetics Foundation, May 2004.
61. "New perspectives on pediatric dystonia", invited lecture at Oregon Health Sciences University, April 2004.
62. "Stiffness, spasticity, and dystonia: diagnosis and management of hypertonia in children", invited lecture at Oregon Health Sciences University, April 2004.
63. "Hypertonia in childhood," educational lecture at the American Academy of Neurology, April 2003.
64. "Botulinum toxin and the types of hypertonia", invited lecture at an Allergan-sponsored symposium on current uses of botulinum toxin, August 2003.
65. "Botulinum toxin type B", invited lecture at an Allergan-sponsored symposium on current uses of botulinum toxin, August 2003.
66. "Hypertonia in childhood," educational lecture at the Child Neurology Society, October 2002.

67. "Spasticity and other Hypertonias," World Congress on Disabilities, invited lecture, September 2002.
68. "Is pediatric dystonia a disorder of plasticity?" invited seminar at the Institute of Neurology and Gatsby Computational Sciences unit of the Queen Square Neurological Institute, December 2000.
69. "Interdisciplinary conference on childhood motor disorders", conference co-chairman and organizer, Toronto, September 2000.
70. "Neural Control of Movement", Satellite conference co-chairman and invited speaker, Key West, April 1999.

#### **Membership in Professional Associations:**

- 1992** American Society of Composers, Authors, and Publishers (ASCAP)
- 1993** Sigma Xi Engineering Society
- 1993** American Medical Association (AMA)
- 1995** American Academy of Pediatrics (AAP)
- 1995** Massachusetts Medical Association (MMA)
- 1995** American Association for the Advancement of Science (AAAS)
- 1995** Institute for Electrical and Electronics Engineers (IEEE)
- 1998** American Physiological Society (APS)
- 1999** Child Neurology Society (CNS)
- 1999** American Academy of Neurology (AAN)
- 2000** Movement Disorders Society (MDS)
- 2002** American Academy of Cerebral Palsy and Developmental Medicine (AACPDM)
- 2012** International Child Neurology Society
- 2014** American Neurological Association (ANA)
- 2015** American Institute of Medical and Biological Engineers (AIMBE)

#### **E. SCHOLARLY PUBLICATIONS**

*Peer-reviewed articles (73 published, 4 in press)*

1. Lunardini, F., Bertucco, M., Casellato, C., Bhanpuri, N., Pedrocchi, A., and **Sanger, T. D.** (2015). Speed-Accuracy Trade-Off in a Trajectory-Constrained Self-Feeding Task A Quantitative Index of Unsuppressed Motor Noise in Children With Dystonia. *Journal of child neurology*, in press.
2. Bhanpuri, N. H., Bertucco, M., Young, S. J., Lee, A. A., and **Sanger, T. D.** (2015). Multiday Transcranial Direct Current Stimulation Causes Clinically Insignificant Changes in Childhood Dystonia A Pilot Study. *Journal of child neurology*, in press.
3. Ghoreyshi A, **Sanger TD** (2015) A Nonlinear Stochastic Filter for Continuous-Time State Estimation. *IEEE Trans. Automatic Control*, in press.
4. Lunardini F, Maggioni S, Casellato C, Bertucco M, Pedrocchi ALD, and **Sanger TD** (2015) Increased task-uncorrelated muscle activity in childhood dystonia. *Journal of NeuroEngineering and Rehabilitation* 12:52.

5. Sohn WJ, Niu CM, and **Sanger TD** (2015) Increased long-latency reflex activity as a sufficient explanation for childhood hypertonic dystonia: a neuromorphic emulation study. *J. Neural Eng.* 12.
6. **Sanger, T. D.** (2014). Risk-Aware Control. *Neural Computation*, 26(12):2669–2691.
7. Bhanpuri, N. H., Bertuccio, M., Ferman, D., Young, S. J., Liker, M. A., Krieger, M. D., and **Sanger, T. D.** (2014). Deep Brain Stimulation Evoked Potentials May Relate to Clinical Benefit in Childhood Dystonia. *Brain stimulation* 7(5), 718-726.
8. Niu, C. M., Nandyala, S. K., and **Sanger, T. D.** (2014). Emulated muscle spindle and spiking afferents validates VLSI neuromorphic hardware as a testbed for sensorimotor function and disease. *Frontiers in computational neuroscience*, 8.
9. Niu, C. M., Lee, K., Houde, J. F., and **Sanger, T. D.** (2014). Vowel generation for children with cerebral palsy using myocontrol of a speech synthesizer. *Frontiers in human neuroscience*, 8.
10. Kukke, S. N., and **Sanger, T. D.**, (2014). Contributors to excess antagonist activity during. *J Child Neurol.* in press
11. **Sanger, TD**, and Kalaska, JF. "Crouching tiger, hidden dimensions." *Nature neuroscience* 17.3 (2014): 338-340.
12. Young, SJ, Bertuccio, M, and **Sanger, TD** (2014). Cathodal Transcranial Direct Current Stimulation in Children With Dystonia A Sham-Controlled Study. *Journal of child neurology*, 29(2), 232-239.
13. Chu, VWT, Sternad, D, and **Sanger, TD**. "Healthy and dystonic children compensate for changes in variability" *J Neurophysiol* 109 (2013): 2169-2178.
14. Bertuccio, M, and **Sanger, TD** (2013) "Speed-Accuracy Testing on the Apple iPad(r) Provides a Quantitative Test of Upper Extremity Motor Performance in Children with Dystonia." *Journal of child neurology* 29(11), 1460-1466.
15. Young, SJ, Bertuccio, M, Sheehan-Stross, R, and **Sanger, TD** (2013). Cathodal transcranial direct current stimulation in children with dystonia a pilot open-label trial. *Journal of child neurology*, 28(10), 1238-1244.
16. Olaya, JE, Christian, E, Ferman, D, Luc, Q, Krieger, MD, **Sanger, TD**, and Liker, MA (2013). Deep brain stimulation in children and young adults with secondary dystonia: the Children's Hospital Los Angeles experience. *Neurosurgical focus*, 35(5), E7.
17. Niu, CM, Nandyala, S, Sohn, WJ, and **Sanger, TD** (2012). Multi-scale Hyper-time Hardware Emulation of Human Motor Nervous System Based on Spiking Neurons using FPGA. *Neural Information Processing Systems*:2012:37-45.
18. Bodison, S, and **Sanger, TD** (2012). Exploring the sensory basis of developmental dyspraxia in children with Autism Spectrum Disorder (ASD). *Seeing and Perceiving*, 25(s1), 63-63.
19. **Sanger, TD**, 2011, Distributed Control of Uncertain Systems using Superpositions of Linear Operators, *Neural Computation*, 23:1911-1934.
20. Kukke, SN, **Sanger, TD**, 2011, Contributors to Excess Antagonist Activity during Movement in Children with Secondary Dystonia due to Cerebral Palsy, *J. Neurophysiology* 105(5):2100-2107.
21. Cramer, SC, Sur, M, Dobkin, BH, O'Brien, C, **Sanger, TD**, *et. al.*, 2011, Harnessing Neuroplasticity for Clinical Applications, *Brain*, 134(pt 6):1591-609.

22. Air, EL, Ostrem, JL, **Sanger, TD**, Starr, PA, 2011, Deep brain stimulation in Children: Experience and Technical Pearls, *J. Neurosurgery: Pediatrics*, 8(6):566-574.
23. Young, SJ, van Doornik, J, and **Sanger, TD**, 2011, Visual Feedback Reduces Co-contraction in Children With Dystonia, *J Child Neurol* 26(1):37-43.
24. Young, SJ, van Doornik, J, and **Sanger, TD**, 2011, Finger Muscle Control in Childhood Dystonia, *Movement Disorders*, 26(7):1290-1296.
25. Kurian, MJ, Li, Y,, **Sanger, TD**, et. al., 2011, Clinical and Molecular Characterisation of Hereditary Dopamine Transporter Deficiency Syndrome: an Observational Cohort and Experimental Study, *The Lancet Neurology*, 10(1):54-62.
26. **Sanger, TD**, 2010, Controlling Variability, *J. Motor Behavior*, 42(6):401-407.
27. **Sanger, TD**, 2010, Neuro-mechanical Control using Differential Stochastic Operators, *Conf. Proc. IEEE EMBC*, full-length refereed conference paper, 2010:4494-7.
28. Bloom, R, Przekop, A, **Sanger, TD**, 2010, Prolonged electromyogram biofeedback improves upper extremity function in children with cerebral palsy, *J Child Neurol* 25(12):1480-4.
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#### *Patents*

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2. **PCT pending**, 2015, Systems, Methods, and Uses of Bayes-Optimal Nonlinear Filtering Algorithm