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# Joseph E. O'Doherty

## *Curriculum Vitae*

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### Research Interests

**Neural Engineering & Systems Neuroscience:** Brain-machine interfaces & neuroprosthetics, multi-electrode recordings, electrical microstimulation, neuronal population analysis & multielectrode techniques, the neuronal basis of movement, multisensory integration.

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### Higher Education

*2001–Present*     **Duke University** (Durham, NC, USA)  
PhD Candidate, Department of Biomedical Engineering.  
Advisor: Miguel A. L. Nicolelis

*1999–2001*     **East Carolina University** (Greenville, NC, USA)  
BS Physics, *Magna Cum Laude*

*1997–1999*     **University of North Carolina at Chapel Hill**  
(Chapel Hill, NC, USA)  
Coursework in Applied Science

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### Research Positions

*2001–Present*     **Doctoral Student** Duke University Center for Neuroengineering (Durham, NC, USA)  
Developing computational algorithms for the training and control of brain-machine interfaces; studying the cortical basis of movement control and somatic sensation in behaving rhesus macaques; probing the effectiveness of cortical microstimulation for brain-machine interface feedback.

*1998*     **Laboratory Technician** University of North Carolina at Chapel Hill, Department of Surgery / Burn Clinic (Chapel Hill, NC, USA)  
Assisted with *in vivo* skin-graft experiments in GFP mice.

## Research Positions (continued)

*1997*                    **Summer Research Fellow** East Carolina University, Department of Pharmacology (Greenville, NC, USA)  
Assessed the impact of Neuropeptide Y antisense on cardiac function in Sprague-Dawley rats. Funding provided by the Howard Hughes Medical Institute SEPP Summer Research Internship program.

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## Teaching Positions

*2003–2007*            **Laboratory Animal Coordinator – “Frogmaster”**  
Duke University, Department of Biomedical Engineering (Durham, NC, USA)  
Instructed students in the ethical and regulatory issues associated with animal research and supervised procedures involving animal tissues conducted in the Bioelectricity laboratory course (BME 101-L).

*2002–2003*            **Teaching Assistant** Duke University, Department of Biomedical Engineering (Durham, NC, USA)  
Taught Bioelectricity laboratory (BME 101-L), three semesters.

*2000–2001*            **Tutor** East Carolina University, Department of Physics (Greenville, NC, USA)  
Tutored students in Mechanics and Electromagnetism.

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## Awards, Honors & Distinctions

*2001*                    Burroughs Welcome Fellowship, UNC Graduate School (declined)  
*2001*                    James Fenly Spear, Jr. Memorial Award  
*2000*                    Phi Kappa Phi National Honor Society  
*2000*                    Thomas A. Bayliss Scholarship in Physics  
*1998*                    State Employees’ Association of North Carolina, Statewide 4-year college scholarship  
*1998*                    State Employees’ Association of North Carolina, District 65 scholarship  
*1997*                    Howard Hughes Medical Institute SEPP Summer Research Internship

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## Other Training

*2002*                    **The Neurosciences Institute** (La Jolla, CA, USA)  
Summer Course in Neural Engineering, directed by Dr. Andrew Schwartz

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## Professional Societies

- 2004–Present Student Member, Society for Neuroscience  
2003–Present Student Member, Biomedical Engineering Society
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## Notable Extracurricular Activities

- 2008–2009 **Committee Member** (Pratt IT Advisory Committee (PITAC), Durham, NC, USA)  
Student representative to the information technology advisory committee for the school of engineering.
- 2005–Present **Bicycle Advocate** (Duke Bicycle Advocates, Durham, NC, USA)  
Active with the Duke Bike Advocates student organization in encouraging, promoting and advocating for bicycles on Duke University’s campus.
- 2003–Present **Radio DJ** (WXDU 88.7 FM, Durham, NC, USA)  
Volunteer playlist DJ for Duke University’s student-run radio station.
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## Publications

### Peer-Reviewed Journal Articles

- O’Doherty, J.E.**, Lebedev, M.A., Hanson, T.L., Fitzsimmons, N.A. and M.A.L. Nicolelis. (2009) A brain-machine interface instructed by direct intracortical microstimulation. *Frontiers in Integrative Neuroscience*, 3:20. doi:10.3389/neuro.07.020.2009
- Li, Z., **O’Doherty, J.E.**, Hanson, T.L., Lebedev, M.A., Henriquez, C.S. and M.A.L. Nicolelis. (2009) Unscented Kalman filter for brain-machine interfaces. *PLoS ONE*, 4(7): e6243. doi:10.1371/journal.pone.0006243
- Lebedev, M.A., **O’Doherty, J.E.** and M.A.L. Nicolelis. (2008) Decoding of temporal intervals from cortical ensemble activity. *The Journal of Neurophysiology*, 99(1): 166–186. doi:10.1152/jn.00734.2007
- Zacksenhouse, M., Lebedev, M.A., Carmena, J.M., **O’Doherty, J.E.**, Henriquez, C.S. and M.A.L. Nicolelis. (2007) Cortical modulations increase in early sessions with brain-machine interface. *PLoS ONE*, 2(7): e619. doi:10.1371/journal.pone.0000619

## Publications (continued)

Lebedev, M.A., Carmena, J.M., **O’Doherty, J.E.**, Zacksenhouse, M., Henriquez, C.S., Principe, J.C. and M.A.L. Nicolelis. (2005) Cortical ensemble adaptation to represent actuators controlled by a brain machine interface. *The Journal of Neuroscience*, 25(19): 4681–4693. doi:10.1523/JNEUROSCI.4088-04.2005

Carmena, J.M., Lebedev, M.A., Crist, R.E., **O’Doherty, J.E.**, Santucci, D.M., Dimitrov, D.F., Patil, P.G., Henriquez, C.S. and M.A.L. Nicolelis. (2003) Learning to control a brain-machine interface for reaching and grasping by primates. *PLoS Biology*, 1(2): e42. doi:10.1371/journal.pbio.0000042

Gumber S.C. and **J.E. O’Doherty**. (1999) Digestive disease resources on the Internet. *The American Journal of Gastroenterology*, 94(8):2022–2032. doi:10.1016/S0002-9270(99)00329-9

## Book Chapters

Hanson, T.L., Fitzsimmons, N.A. and **J.E. O’Doherty**. (2007) Technology for Multielectrode MicroStimulation of Brain Tissue, in *Methods for Neural Ensemble Recordings, Second Edition*. Nicolelis, M.A.L., Editor. CRC Press.

## Abstracts

Li, Z., **O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2009). Simultaneous BMI decoding and tuning model update using Bayesian regression. In *Society for Neuroscience 39th Annual Meeting*, Chicago, Illinois.

Zacksenhouse, M., Beiser, K., **O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2009). Optimal control framework successfully explains changes in neural modulations during experiments with Brain Machine Interfaces. In *2009 Advances in Computational Motor Control*, Chicago Illinois.

**O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2008). Closed-loop brain-controlled reaching guided by cortical microstimulation. In *Society for Neuroscience 38th Annual Meeting*, Washington, DC.

Grant, B.D., Li, Z., Hanson, T.L., **O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2008). Multipurpose, expandable suite for brain-machine interfaces. In *Society for Neuroscience 38th Annual Meeting*, Washington, DC.

## Publications (continued)

Li, Z., **O’Doherty, J.E.**, Hanson, T.L., Lebedev, M.A., Henriquez, C.S., Nicolelis, M.A.L. (2008). Unscented Kalman filter for brain-machine interfaces. In *Society for Neuroscience 38th Annual Meeting*, Washington, DC.

Hodak, M.J., **O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2008). Transformational mapping in an online brain-machine interface for reaching. In *Society for Neuroscience 38th Annual Meeting*, Washington, DC.

**O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2008). Closed-loop brain-controlled reaching guided by cortical microstimulation. *Neural Interfaces Conference 2008*, Cleveland, OH.

**O’Doherty, J.E.**, Hanson, T.L., Dimitrov, D.F., Lebedev, M.A., Nicolelis, M.A.L. (2007). Brain-machine interface with somatosensory feedback. In *Society for Neuroscience 37th Annual Meeting*, San Diego, CA.

Grant, B.D., Hanson, T.L., **O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2007). Automated spike sorting of multiunit data for brain-machine interface applications. In *Society for Neuroscience 37th Annual Meeting*, San Diego, CA.

Li, Z., **O’Doherty, J.E.**, Hanson, T.L., Lebedev, M.A., Henriquez, C.S., Nicolelis, M.A.L. (2007). N-th order Kalman filter improves the performance of a brain machine interface for reaching. In *Society for Neuroscience 37th Annual Meeting*, San Diego, CA.

Sameshima, K., Lana, L., Takahashi, D.Y., **O’Doherty, J.E.**, Lebedev, M.A., Nicolelis, M.A.L. (2007). Characterization of interactions between motor areas during a self-timed motor task in a monkey. In *Society for Neuroscience 37th Annual Meeting*, San Diego, CA.

**O’Doherty, J.E.**, Lebedev, M.A., Henriquez, C.S. and Nicolelis, M.A.L. (2005). Ensemble representation of time: interhemispheric communication involved? In *Society for Neuroscience 35th Annual Meeting*, Washington, DC.

Shi, X., **O’Doherty, J.E.**, De Araujo, I., Lin, S., Hanson, T., Lebedev, M.A., Ribeiro, S., Nicolelis, M.A.L. (2005). Neuronal correlations and mnemonic reverberation in rhesus monkeys during sleep. In *Society for Neuroscience 35th Annual Meeting*, Washington, DC.

## Publications (continued)

Zacksenhouse, M., Lebedev, M.A., Carmena, J.M., **O'Doherty, J.E.**, Henriquez, C.S., Nicolelis, M.A.L. (2005). Trends in firing rate statistics mirroring changes in task performance during training with brain machine interfaces. In *Society for Neuroscience 35th Annual Meeting*, Washington, DC.

Zacksenhouse, M., Lebedev, M.A., **O'Doherty J.E.**, Carmena, J.M., Henriquez, C.S. and Nicolelis, M.A.L. (2005). Correlated ensemble activity increased when operating a brain machine interface. In *Fourteenth Annual Computational Neuroscience Meeting*, Madison, WI.

**O'Doherty, J.E.**, Won, D.S., Zacksenhouse, M., Lebedev, M.A., Carmena, J.M., Nicolelis, M.A.L., Wolf, P.D. and Henriquez, C.S. (2004). Data Reduction Of Simultaneous Multi-Electrode Neural Recordings Using Principal Component Analysis. In *Annual Fall Meeting of the Biomedical Engineering Society*, Philadelphia, PA.

**O'Doherty, J.E.**, Hugh, G.S., Zacksenhouse, M., Lebedev, M.A., Carmena, J.M., Henriquez, C.S. and Nicolelis, M.A.L. (2004). Simulation of a brain-machine interface in a model sensorimotor system. In *Society for Neuroscience 34th Annual Meeting*, San Diego, CA.

Lebedev, M.A., **O'Doherty, J.E.**, Zacksenhouse, M., Carmena, Henriquez, C.S. and Nicolelis, M.A.L. (2004). Directional tuning in neuronal ensembles. In *Society for Neuroscience 34th Annual Meeting*, San Diego, CA.

Zacksenhouse, M., Lebedev, M.A., **O'Doherty, J.E.**, Carmena J.M., Henriquez C.S. and Nicolelis, M.A.L. (2004). Cortical neurons tuning to multiple spatiotemporal patterns of movement. In *Society for Neuroscience 34th Annual Meeting*, San Diego, CA.

Won, D.S., **O'Doherty, J.E.**, Carmena, J.M., Phelps, E.E., Nicolelis, M.A.L., Henriquez, C.S. and Wolf, P.D. (2004). A comparison of linear predictor performance using unsorted and sorted neural spike activity. In *Society for Neuroscience 34th Annual Meeting*, San Diego, CA.

Zacksenhouse, M., Lebedev, M.A., **O'Doherty, J.E.**, Carmena, J.M., Henriquez, C.S. and Nicolelis, M.A.L. (2004). Operation of brain-machine interface increases the variance and degree of correlation in fronto-parietal cortical activity. In *Eighth International Conference on Cognitive and Neural Systems*, Boston, MA.

## Publications (continued)

**O'Doherty, J.E.**, Lebedev, M.A., Carmena, J.M., Nicolelis, M.A.L. and Henriquez, C.S. A random-walk analysis for the evaluation and design of motor control tasks. (2003). In *Annual Fall Meeting of the Biomedical Engineering Society*, Nashville, TN.

Carmena J.M., Lebedev M.A., **O'Doherty J.E.**, Henriquez C.S. and Nicolelis M.A.L. (2003). Fronto-parietal reorganization underlies incorporation of robot dynamics by the primate cortex during operation of a reaching and grasping brain-machine interface. In *Society for Neuroscience 33rd Annual Meeting*, New Orleans, LA.

Lebedev, M.A., Carmena, J.M, **O'Doherty, J.E.**, Henriquez, C.S. and Nicolelis, M.A.L. (2003) Directional tuning of frontal and parietal neurons during operation of a brain-machine interface. In *Society for Neuroscience 33rd Annual Meeting*, New Orleans, LA.

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## Talks & Other Scholarly Presentations

- 24 Sep & 15 Oct 2009      **Guest Lectures** (Host: Linda Franzoni) *Introduction to Neuroengineering*. EGR 10 - Introduction to Engineering, Duke University, Durham, NC, USA
- 9 Apr 2009                **Guest Lecture** (Host: Warren Grill) *Fundamentals of Central Nervous System Recording*. BME 265 - Advanced Topics in Neural Prosthetic Systems, Duke University, Durham, NC, USA
- 3 Apr 2009                **Invited Speaker** (Host: Warren Grill) *Direct Brain-Machine-Brain Communication Through Simultaneous Cortical Stimulation and Recording*. Grill Lab Seminar, Department of Biomedical Engineering, Duke University, Durham, NC, USA
- 3 Nov 2008                **Invited Speaker** (Host: Krishna Shenoy) *Closed-Loop Brain-Controlled Reaching Guided by Cortical Microstimulation*. Neural Prosthetic Systems Laboratory, Stanford University, Palo Alto, CA, USA
- 24 June 2008             **Guest Lecture** (Host: Dianne Kindel) *Monkeys and Robots Together at Last: An Overview of the Brain-Machine Interface*. Bioscience and Engineering Camp 2008, Duke University, Durham, NC, USA
- 17 June 2008             **Platform Presentation** *Closed-Loop Brain-Controlled Reaching Guided by Cortical Microstimulation*. Neural Interfaces Conference 2008, Cleveland, OH, USA

## Talks & Other Scholarly Presentations (continued)

- 2 April 2008 **Guest Lecture** (Host: Craig Henriquez) *From Action Potential to Action*. BME 253 - Computational Neuroengineering, Duke University, Durham, NC, USA
- 25 October 2007 **Guest Lecture** (Host: Marcus Henderson) *From Action Potential to Action*, EGR 10 - Introduction to Engineering, Duke University, Durham, NC, USA
- 28 July 2006 **Invited Speaker** (Host: Warren Grill) *BMIs for Restoring Motor Function*. Grill Lab Seminar, Department of Biomedical Engineering, Duke University, Durham, NC, USA
- 28 March 2006 **Guest Lecture** (Host: Craig Henriquez) *BMIs for Restoring Motor Function*. BME 253 - Computational Neuroengineering, Duke University, Durham, NC, USA
- 8 July 2005 **Invited Speaker** (Host: Iyad Obeid) *Overview of Brain-machine Interface Software Algorithms*. Neural Rehabilitation Engineering Lab, Université catholique de Louvain, Brussels, Belgium
- 5 July 2005 **Invited Speaker** (Host: Joseph McIntyre) *Brain-machine Interfaces for Restoring Motor Function*. Laboratoire de Physiologie de la Perception et de l'Action. Collège de France, Paris, France
- 30 June 2005 **Invited Speaker** (Host: Matthew Diamond) *Brain-machine Interfaces for Restoring Motor Function*. Cognitive Neuroscience Sector, SISSA, Trieste, Italy
- March 2005 **Speaker** *Predicting Time With Ensembles: Inter-hemispheric Transfer of Knowledge*. Nicoletis Lab Seminar, Duke University, Durham, NC, USA
- 14 October 2004 **Conference Speaker** *Data Reduction of Simultaneous Multi-electrode Neural Recordings Using Principal Component Analysis*. Annual fall meeting of the Biomedical Engineering Society, Philadelphia, PA, USA
- February 2004 **Invited Speaker** *Neuroengineering a Brain-Machine Interface*. Department Of Biomedical Engineering Seminar Series, Duke University, Durham, NC, USA