CURRICULUM VITAE
Carlos E. Vargas-Irwin, PhD

PERSONAL INFORMATION

Business Address: Brown University, 185 Meeting Street Box GL-584 Providence RI, 02912

Business Telephone: 401-863-1874

E-mail Address: Carlos_Vargas_Irwin@Brown.edu

Place of Birth: Santiago de Cali, Colombia

Citizenship: Colombian

(permanent legal resident of the USA, EB1A Alien of extraordinary ability)

EDUCATION

PhD, Neuroscience, 2010
Brown University Department of Neuroscience, Division of Biology and Medicine,
Providence, RI

Bachelor of Science with Honors in Neuroscience, 2002
Brown University, Providence, RI

PERSONAL STATEMENT

My long-term goal is to understand the principles of information processing in cortical circuits in order to develop new technologies to improve the quality of life for persons living with neuromotor disorders. My research has focused on the relationship between the activity of motor cortical neurons and the dexterous control of the arm and hand. Movements that involve the simultaneous and partially independent control of multiple degrees of freedom are a concrete, measurable, representation of the high-dimensional output of the nervous system. Relating these complex movement measurements to the activity of hundreds of simultaneously recorded cortical neurons provides a unique perspective on biological computation. My doctoral thesis project (Decoding complete reach and grasp actions from local primary motor cortex populations) was featured in Nature's Research Highlights (Vol 466|29 July 2010). My work has also been recognized with a NIH Director's New Innovator $1.5M award funding a research plan to develop new brain computer interface (BCI) systems that directly incorporate surrogate sensory data obtained from external sensors into a neuromotor decoding framework. More recently, I also received the Zimmerman Innovation award from the Carney institute for Brain Science to examine the role of sense of agency during BCI use. The results of my research have contributed to our understanding of the nervous system as well as the development of technology aimed to help people with paralysis. My ongoing collaboration with the BrainGate2 clinical trial has allowed me to directly apply the results of my research in a clinical setting. My most recent work is aimed at harnessing the high dimensional control signals driving hand and finger movements in the human precentral gyrus, allowing people with limited mobility to control tablet computers using intended hand gestures in an intuitive way. I have also contributed to mentoring graduate students in various departments and collaborated on the development of online courses at Brown. My next professional goal is to establish a long-term research program through a tenure-track position and further develop my role as a mentor and instructor, harnessing new technologies to expand current educational environments.

HONORS AND AWARDS

2022   Zimmerman Innovation Award in Brain Science
       (Collaboration with Dr. Joo-Hyun Song, Brown University CLPS department)
       Quantitative evaluation of sense of agency during intracortical brain-computer interface use

2018   NIH Director's New Innovator Award
       Synergistic Effector/Environment encoding: A new perspective on motor cortex and brain-computer
       interfaces

2015   Top 5 finalist in the Conquer Paralysis Now Grand Challenge ("Out of the Box" category)

2010   Doctoral thesis project featured in Nature's Research Highlights (Nature, Vol 466|29 July 2010)

ACADEMIC APPOINTMENTS

Assistant Professor (Research), Brown University Neuroscience Department,
Providence, RI 2016 - present

Investigator, Brown University Neuroscience Department,
Providence, RI 2014 - 2016

Post-doctoral research associate, Brown University Neuroscience Department,
Providence, RI 2010 – 2014

PhD dissertation research, Brown University Neuroscience Department,
Providence, RI 2003 – 2010

Laboratory Technician 2002 – 2003

TEACHING ROLES

Guest lecturer for Social Impact of Emerging Technologies – The Role of Engineers
(ENGN 1931J) (instructor: Arto Nurmikko) Brown University, Providence, RI, USA. Brain
Computer Interface Technology: state of the art. October 13th, 2022

Guest lecturer for Neuroengineering (ENGN1220) (instructor: Dr. Leigh Hochberg / Arto
Nurmikko) Brown University, Providence, RI, USA. Mind reading 101: Introduction to Neural
Decoding. March 23rd, 2017, April 10th, 2018, March 21st, 2019, April 2nd, 2020, March
15th, 2022

Guest lecturer for Visually-guided actions and cognitive process (instructor: Dr. Joo-Hyun
Song) Brown University, Providence, RI, USA. Motor Cortex: Past, Present, and Future.
April 4th, 2016, Nov. 20th, 2017, April 14th, 2022

Prepared modules on dimensionality reduction and spike sorting for the Exploring Neural Data
Massive Open Online Course (MOOC), organized by David Sheinberg and Monica Linden and
offered through Coursera by Brown University, 2014

Instructor/course designer for: "From Brain to Sensation: Neurobiology of Perception", Brown
University "SPARK: Science for Middle School" program, 2004 – 2014

Graduate Teacher's Assistant for: "The Brain: an introduction to Neuroscience", Brown University Neuroscience Department. Instructors: Dr. John Stein, Dr. Michael Paradiso, 2003-2004

AD HOC REVIEWER

Nature
Communications
Cell Reports
Journal of Neuroscience

Journal of
Neurophysiology
Journal of
Neuroscience Methods
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Neural Systems & Rehabilitation
Engineering Journal of Neural Engineering
Journal of Neuroengineering and
Rehabilitation Computer Methods and
Programs in Biomedicine

MEMBERSHIP IN SOCIETIES

Society for Neuroscience, 2002 - present
Neural Control of Movement Society, 2010 - present

PUBLICATIONS

Citation statistics (Thomson Reuters Web of Science)
Sum of times Cited: 1,493
Sum of times Cited without self-citations: 1,439
Citing Articles: 1,170
Citing Articles without self-citations: 1,152
Average Citations per Item: 71.1
H-Index: 13

1. Auditory cues reveal intended movement information in middle frontal gyrus neuronal ensemble activity of a person with tetraplegia. Hosman T, Hynes JB, Saab J, Wilcoxen KG, Buchbinder BR, Schmansky N, Cash SS, Eskandar EN, Simeral JD, Franco B, Kelemen J, **Vargas-Irwin CE**, Hochberg LR. Scientific reports. 2021 Jan 11;11(1):1-7.

2. Neural representation of observed, imagined, and attempted grasping force in motor cortex of individuals with chronic tetraplegia. Rastogi A, **Vargas-Irwin CE**, Willett FR, Abreu J, Crowder DC, Murphy BA, Memberg WD, Miller JP, Sweet JA, Walter BL, Cash SS. Scientific reports. 2020 Jan 29;10(1):1-6.

3. The neural representation of force across grasp types in motor cortex of humans with tetraplegia. Rastogi A, Willett FR, Abreu J, Crowder DC, Murphy BA, Memberg WD, **Vargas-Irwin CE**, Miller JP, Sweet J, Walter BL, Rezaii PG. Eneuro. 2021 Jan 22.

4. Big brown bats are challenged by acoustically-guided flights through a circular tunnel of hoops. Simmons JA, Brown PE, **Vargas-Irwin CE**, Simmons AM. Scientific reports. 2020 Jan 21;10(1):1-0.

5. Watch, Imagine, Attempt: Motor cortex single unit activity reveals context-dependent movement encoding in humans with tetraplegia. **Vargas-Irwin CE**, Feldman JM, King B, Simeral JD, Sorice BL, Oakley EM, Cash SS, Eskandar EN, Friehs GM, Hochberg LR, Donoghue JP. Frontiers in human neuroscience. 2018;12:450.

6. Spike-train similarity (SSIMS) method detects effects of obstacle proximity and experience on temporal patterning of bat biosonar. Accomando, A. W., **Vargas-Irwin, C. E**., & Simmons, J. A. (2018). Frontiers in Behavioral Neuroscience, 12, 13. *** Winner of the European Acoustics Association Best Paper & Presentation Award for young Researchers**

7. Phase reorganization leads to transient β-LFP spatial wave patterns in motor cortex during steady-state movement preparation. Rule ME, **Vargas-Irwin C**, Donoghue JP, Truccolo W. J Neurophysiol. 2018 Jun 1;119(6):2212-2228. doi: 10.1152/jn.00525.2017. Epub 2018 Feb 14.

8. Rapid calibration of an intracortical brain–computer interface for people with tetraplegia. Brandman, D.M., Hosman, T., Saab, J., Burkhart, M.C., Shanahan, B.E., Ciancibello, J.G., Sarma, A.A., Milstein, D.J., **Vargas-Irwin, C.E**., Franco, B. and Kelemen, J., 2018. Journal of neural engineering, 15(2), p.026007.

9. Dissociation between sustained single-neuron spiking and transient β-LFP oscillations in primate motor cortex. Rule, M. E., **Vargas-Irwin, C. E**., Donoghue, J. P., & Truccolo, W. (2017). Journal of Neurophysiology, 117(4), 1524-1543.

10. Linking Objects to Actions: Encoding of Target Object and Grasping Strategy in Primate Ventral Premotor Cortex. **Vargas-Irwin CE**, Franquemont L, Black MJ, Donoghue JP. J Neurosci. 2015; 35(30):10888-97.

11. Spike train SIMilarity Space (SSIMS): a framework for single neuron and ensemble data analysis. **Vargas-Irwin CE**, Brandman DM, Zimmermann JB, Donoghue JP, Black MJ. Neural Comput. 2015 Jan;27(1):1-31

12. Optogenetically induced spatiotemporal gamma oscillations and neuronal spiking activity in primate motor cortex. Lu Y, Truccolo W, Wagner FB, **Vargas-Irwin CE**, Ozden I, et al. Journal of neurophysiology. 2015; 113(10):3574-87.

13. Contribution of LFP dynamics to single-neuron spiking variability in motor cortex during movement execution. Rule ME, **Vargas-Irwin C**, Donoghue JP, Truccolo W. Frontiers in systems neuroscience. 2015; 9:89.

14. Failure mode analysis of silicon-based intracortical microelectrode arrays in non-human primates. Barrese JC, Rao N, Paroo K, Triebwasser C, **Vargas-Irwin C**,

Franquemont L, Donoghue JP. J Neural Eng. 2013 Dec;10(6):066014. doi: 10.1088/1741-2560/10/6/066014. Epub 2013 Nov 12.

15. Decoding 3D reach and grasp from hybrid signals in motor and premotor cortices: spikes, multiunit activity, and local field potentials. Bansal, AK.; Truccolo, W; **Vargas-Irwin, CE** Donoghue JP. J Neurophysiology 2012 Mar; 107(5); 1337-55

16. Relationships among low-frequency local field potentials, spiking activity, and three-dimensional reach and grasp kinematics in primary motor and ventral premotor cortices. Bansal AK, **Vargas- Irwin CE**, Truccolo W, Donoghue JP. J Neurophysiol. 2011 Apr;105(4):1603-19. Epub 2011 Jan 27.

17. Decoding 3-D Reach and Grasp Kinematics from High-Frequency Local Field Potentials in Primate Primary Motor Cortex   Zhuang, J., Truccolo, W., **Vargas-Irwin, C**., Donoghue, J.P.IEEE Transactions in Biomedical Engineering vol.57, No. 7, July 2010.

18. Decoding complete reach and grasp actions from local primary motor cortex populations. **Vargas- Irwin CE**, Shakhnarovich G, Yadollahpour P, Mislow JMK, Black MJ, Donoghue JP. J Neurosci. 2010 Jul 21;30 (29):9659-69.
Featured in Nature's Research Highlights (Nature, Vol 466|29 July 2010).

19. Automated spike sorting using density grid contour clustering and subtractive waveform decomposition. J Neurosci Methods. **Vargas-Irwin C**, Donoghue JP. 2007 Aug 15;164(1):1-18.

20. Reliability of signals from a chronically implanted, silicon-based electrode array in non-human primate primary motor cortex. Suner S, Fellows MR, **Vargas-Irwin C**, Nakata GK, Donoghue JP. IEEE Trans Neural Syst Rehabil Eng. 2005 Dec;13(4):524-41.

21. On the variability of manual spike sorting. Wood F, Black MJ, **Vargas-Irwin C**, Fellows M, Donoghue JP. IEEE Trans Biomed Eng. 2004 Jun;51(6):912-8.

PATENTS

Donoghue J, Vargas-irwin C, inventors; Brown University, assignee. Synergistic effector/environment decoding system. United States patent application US 16/589,615. 2020 Apr 2.

INVITED PRESENTATIONS

1. BrainGate 2 Summit
Host: Jaime Henderson
Half Moon Bay, California, August 4th, 2022
Latent space alignment, Intrinsic event detection, & mapping the computational space of neurons

2. Center for Neurorestoration and Neurotechnology Virtual Seminars (Providence Veteran's Association)Turning thought into Action: State space analysis of neural activity patterns in human motor cortex, , October 6th, 2020

3. Boston Action Club Lecture Series
(Northeastern University) February 6th, 2020
Models of Neural Computation in Motor Cortex: past, present, and future

4. BrainGate2 Summit
Host: Dr. Leigh Hochberg
Boston, MA, USA, August 1st, 2018
Gesture based decoding: progress & opportunities

5. The Rowland Institute at Harvard
Host: RoLi lab (Dr. Drew Robson & Dr. Jennifer
Li) Cambridge, MA, USA, July 25th, 2018
Relational decoding for neurons and networks: Using similarity metrics to explore neural computation

6. Northeastern University
Host: Action Lab (Dr. Dagmar
Strenad) Boston, MA, USA, June
19th, 2018
Exploring high-dimensional neural computation: Relational Encoding of cortical ensemble activity

7. Translational Neuroscience and Neural Engineering
Summer Workshop Salve Regina University
Newport, RI, USA, June 8th, 2018
Motor cortical control of reaching and grasping actions in non-human primates

8. BrainGate2 Summit
Host: Dr. Leigh Hochberg
Middletown, RI, USA, August 9, 2017
Single Unit Neural activity in the Human Middle Frontal Gyrus

9. Wyss Center for Bio and Neuroengineering
NeuroTalks series Host: Dr. John Donoghue
Geneva, Switzerland, April 28th, 2017
A relational approach to identifying functionally linked neuronal sub-networks

10. Brown Institute of Brain Science Lunch
talk series Brown University, Providence,
RI, USA, Dec. 10, 2015
Exploring high-dimensional neural computation: Relational encoding of cortical ensemble activity

11. Human Single Neuron Recordings Conference
Johns Hopkins University, Baltimore, Maryland, USA November 14, 2014
Exploring the neural representation of attempted, imagined, and observed actions

in human motor cortex using spike train similarity analysis

12. BrainGate2 Summit
    Host: Dr.Leigh Hochberg
    Newport, RI, USA, August 6, 2014
    Watch, Imagine, Attempt: context dependent encoding of movement direction in human primary motor cortex

13. Guest lecture for Advanced Systems Neuroscience (instructor: Dr. David Sheinberg) Brown University, Providence, RI, USA, March 20, 2014
    Exploring neural codes for movement direction in primary motor cortex

14. Southern New England American Association for Laboratory Animal Science Winter Meeting Pfizer Research Institute, Groton, CT, USA, February 20, 2013
    Movement decoded: exploring neural control of the primate upper limb

15. Max Planck Institute for Biological
    Cybernetics Tübingen, Germany,
    May 2, 2012
    Exploring the role of ventral premotor cortex in reach-to-grasp movements: neural trajectories through spike train similarity space

16. Stanford University
    Host: Shenoy Lab (Dr. Krishna
    Shenoy) Stanford, CA, USA, July
    21, 2011
    Exploring the role of ventral premotor cortex in reach-to-grasp movements using spike train similarity

17. Workshop on Real Time Brain Interfacing Applications
    Ohio State University Mathematical Biosciences Institute, Columbus, OH, USA, May 13, 2008 Automated Spike Sorting for large datasets using Density Grid Contour Clustering

CONFERENCE ABSTRACTS

Society for Neuroscience Annual Meeting 2021
Blind source separation using ICA reveals event-specific components of primate motor cortex LFPs. ***D. ORELLANA**[1], J. B. HYNES[2], J. DONOGHUE[2,3], C. VARGAS-IRWIN[2,3,4]; [1]Pontificia Univ. Javeriana (Pontifical Xavierian Univ), Bogota, Colombia; [2]Neurosci., Brown, Providence, RI; [3]Robert J. and Nancy D. Carney Inst. for Brain Sci., Providence, RI; [4]Ctr. for Neurorestoration and Neurotechnology, Rehabil. Res. and Develop. Service, Dept. of Veterans Affairs Med. Ctr., Providence, RI

Simulation based inference in the Human Neocortical Neurosolver neural modeling software uncovers circuit mechanisms of primate motor cortical 15-29 Hz beta activity during motor planning. ***N. TOLLEY**[1], P. L. RODRIGUES[2], A. GRAMFORT[2], J. DONOGHUE[1], C. VARGAS-IRWIN[1], S. R. JONES[1]; [1]Brown Univ. Grad. Dept. of Neurosci., Providence, RI; [2]Univ. Paris-Saclay, Inria, CEA, Palaiseau, France

Influence of sensory feedback signals on motor cortex during hand movement using a soft robotic glove. ***J. T. GUSMAN**[1,2,4], D. S. DE LUCENA[5], C. E. VARGAS-IRWIN[3,2,4], A. KAPITONAVA[6], D. A. WAGNER[5], T. HOSMAN[1,2,4], C. WALSH[5], L. R. HOCHBERG[4,1,6,7,2]; [1]Sch. of Engin., [2]Carney Inst. for Brain Sci., [3]Dept. of Neurosci., Brown Univ., Providence, RI; [4]VA RR&D Ctr. for Neurorestoration and Neurotechnology, Dept. of VA Med. Ctr., Providence, RI; [5]John A. Paulson Sch. of Engin. and Applied Sci., Harvard Univ., Cambridge, MA; [6]Ctr. for Neurotechnology and Neurorecovery, Dept. of Neurol., Massachusetts Gen. Hosp., Boston, MA; [7]Dept. of Neurol., Harvard Med. Sch., Boston, MA

Interaction of effector and direction encoding in motor cortex of a person with tetraplegia during a bimanual task. ***T. HOSMAN**[1,2,4], C. E. VARGAS-IRWIN[3,2,4], A. KAPITONAVA[5], L. R. HOCHBERG[4,5,1,2,6], J. D. SIMERAL[4,1,2]; [1]Sch. of Engin., [2]Carney Inst. for Brain Sci., [3]Dept. of Neurosci., Brown Univ., Providence, RI; [4]VA RR&D Ctr. for Neurorestoration and Neurotechnology, Dept. of VA Med. Ctr., Providence, RI; [5]Ctr. for Neurotechnology and Neurorecovery, Dept. of Neurol., Massachusetts Gen. Hosp., Boston, MA; [6]Dept. of Neurosci., Harvard Med. Sch., Boston, MA

Society for Neuroscience Annual Meeting 2019 Posters, Chicago, IL
Decoding motor tasks through supervised subspace alignment
*I. PENIDO[1,2], J. B. HYNES[3], J. P. DONOGHUE[4], C. E. VARGAS-IRWIN[1]; [1]Neurosci., Brown Univ., Providence, RI; [2]Carney Inst. for Brain Sci., Providence, RI; [3]Neurosci., Brown, Providence, RI; [4]Wyss Ctr. For Bio and Neuro Engin., Geneva, Switzerland

Inter-areal functional neuronal network dynamics in primate primary and premotor cortex during reaching and grasping movements
*J. B. HYNES[1], C. E. VARGAS-IRWIN[2], J. P. DONOGHUE[2]; [1]Neurosci., Brown, Providence, RI; [2]Neurosci., Brown Univ., Providence, RI

Human middle frontal gyrus exhibits activity related to both eye movements and intended hand movements
*K. G. WILCOXEN[1,2,4], T. HOSMAN[3,2,4], J. B. HYNES[1], J. SAAB[3,4,2], B. R. BUCHBINDER[5], N. SHMANSKY[5], S. S. CASH[6,9], E. N. ESKANDAR[7], J. D. SIMERAL[10,3,6,2], B. FRANCO[6], J. KELEMAN[6], C. E. VARGAS-IRWIN[1,2,4], L. R. HOCHBERG[4,3,8,9,2]; [1]Neurosci., [2]Carney Inst. for Brain Sci., [3]Engin., Brown Univ., Providence, RI; [4]VA RR&D Ctr. for Neurorestoration and Neurotechnology, Dept. of Veterans Affairs Med. Ctr., Providence, RI; [5]Radiology, [6]Neurol., [7]Neurosurg., [8]Ctr. for Neurorestoration and Neurorecovery, Dept. of Neurol., Massachusetts Gen. Hosp., Boston, MA; [9]Neurol., Harvard Med. Sch., Boston, MA; [10]Rehab R&D Service, VA Ctr. for Neurorestoration and Neurotechnology, Providence, RI

Identifying changes in volitional state and BCI task engagement based on the intrinsic structure of neural ensemble activity patterns in motor cortex of people with tetraplegia *T. K. PUN[1,2], A. J. CATOYA[3], C. E. VARGAS-IRWIN[4,2,5], S. S. CASH[6,8], J. D. SIMERAL[5,1,7,2], L.R. HOCHBERG[5,1,7,8,2]; [1]Sch. of Engin., [2]Carney Inst. for Brain

Sci., [3]Dept. of Mol. Pharmacology, Physiology, and Biotech., [4]Dept. of Neurosci., Brown Univ., Providence, RI; [5]VA RR&D Ctr. for Neurorestoration and Neurotechnology, Dept. of VA Med. Ctr., Providence, RI; [6]Dept. of Neurol., [7]Ctr. for Neurotechnology and Neurorecovery, Dept. of Neurol., Massachusetts Gen. Hosp., Boston, MA; [8]Dept. of Neurol., Harvard Med. Sch., Boston, MA

27th Annual Computational Neuroscience Meeting, 2018, Seattle, WA
SIMNETS: a novel mathematical framework to detect functional neuronal sub-ensembles
Jacqueline Hynes[1], David Brandman[2], John Donoghue[1], Carlos Vargas-Irwin[1]
[1]*Brown University, Department of Neuroscience, Providence, RI, United States;*
[2]*Brown University, Department of Engineering, providence, RI, United States*

Society for Neuroscience Annual Meeting 2018 Posters, San Diego, CA
LFP signature of an optimal preparatory subspace in primate reaching and grasping motor networks. J. B. HYNES, C. E. VARGAS-IRWIN, J. P. DONOGHUE; Neurosci., Brown, Providence, RI

Stability of single-unit and ensemble-level tuning in primate primary motor and premotor cortex through extensive practice of a motor skill. K. PAROO[1], C. E. VARGAS-IRWIN[1], L. FRANQUEMONT[1], J. P. DONOGHUE[1,2]; [1]Neurosci., Brown Univ., Providence, RI; [2]Wyss Ctr. for Bio and Neuro Engin., Geneva, Switzerland

Single unit activity in middle frontal gyrus of a person with tetraplegia reveals sensory specific modulation. K. G. WILCOXEN[1,2], C. E. VARGAS-IRWIN[1,2], J. B. HYNES[1,2], T. HOSMAN[3,2], J. SAAB[3,4,2], B. FRANCO[5], J. KELEMAN[5], E. N. ESKANDAR[6], J. P. DONOGHUE[1,3,2,7], L. R. HOCHBERG[4,3,5,8,2]; [1]Dept. of Neurosci., [2]Carney Inst. for Brain Sci., [3]Sch. of Engin., Brown Univ., Providence, RI; [4]Dept. of VA Med. Ctr., VA RR&D Ctr. for Neurorestoration and Neurotechnology, Providence, RI; [5]Dept. of Neurol., [6]Neurosurg., Massachusetts Gen. Hosp., Boston, MA; [7]Wyss Ctr., Geneva, Switzerland; [8]Dept. of Neurol., Harvard Med. Sch., Boston, RI

Multiple grasp types can be reliably decoded from the precentral gyrus of people with ALS with progressive levels of motor impairment
K. T. HUANG[1,2,5], D. M. BRANDMAN[3,2,6,4], J. SAAB[1,2,7], V. CHAVAKULA[1,2,5], C. E. VARGAS- IRWIN[3,2], S. E. FASOLI[8,2,7], C. H. BLABE[9], B. L. SORICE[17], B. JAROSIEWICZ[3,2,7,18], J. P. DONOGHUE[19,3,2,1], J. M. HENDERSON[10,11,12], K. V. SHENOY[13,14,15,16,11], L. R. HOCHBERG[17,2,1,7]. [1]Sch. of Engin., [2]Carney Inst. for Brain Sci., [3]Neurosci., [4]Neurosci. Grad. Program, Brown Univ., Providence, RI; [5]Neurosurg., Brigham and Women's Hosp., Boston, MA; [6]Neurosurg., Dalhousie Univ., Halifax, NS, Canada; [7]Ctr. for Neurorestoration and Neurotechnology, Providence Veterans Affairs Med. Ctr., Providence, RI; [8]MGH Inst. of Hlth. Professions, Boston, MA; [9]Dept. of Neurology, Stanford Univ. Sch. of Med., Stanford Univ., Palo Alto, CA; [10]Dept. of Neurosurg., [11]Stanford Neurosci. Inst., [12]Bio-X

Program, [13]Howard Hughes Med. Inst., [14]Electrical Engin., [15]Bioengineering, [16]Neurobio., Stanford Univ., Stanford, CA; [17]Neurol., Massachusetts Gen. Hosp., Boston, MA; [18]Present affiliation: NeuroPace, Inc., Mountain View, CA; [19]Wyss Ctr., Geneva, Switzerland

Society for Neuroscience Annual Meeting 2017 Posters, Washington, DC

Consistency between task-related neural sub-spaces within and between subjects: Potential for universal neural decoders?

C. E. VARGAS-IRWIN[1], J. HYNES[1], J. B. ZIMMERMANN[1,2], J. P. DONOGHUE[2,1]; 1Dept. of Neurosci., Brown Univ., Providence, RI; 2Wyss Ctr. For Bio and Neuro Engin., Geneva, Switzerland

Evaluation of neural modulation during attempted force production across multiple hand grasp configurations in intracortical BCI users with chronic tetraplegia

A. RASTOGI[1], F. R. WILLETT[1,2], B. A. MURPHY[1], W. D. MEMBERG[1], B. L. WALTER[3], J. P. MILLER[4], J. A. SWEET[4], J. SAAB[5,8,6], B. FRANCO[9], J. N. KELEMEN[9], C. E. VARGAS- IRWIN[7,6], L. R. HOCHBERG[9,5,10,6,8], R. F. KIRSCH[1,2], A. B. AJIBOYE[1,2]; 1Biomed. Engin., Case Western Reserve Univ., Cleveland, OH; 2FES Ctr. of Excellence, Rehabil. R&D Service, Louis Stokes Cleveland Dept. of VA Med. Ctr., Cleveland, OH; 3Neurol., 4Neurosurg., UH Case Med. Ctr., Cleveland, OH; 5Sch. of Engin., 6Inst. for Brain Sci., 7Dept. of Neurosci., Brown Univ., Providence, RI; 8Ctr. for Neurorestoration and Neurotechnology, Rehab. R&D Service, Dept. of VA Med. Ctr., Providence, RI; 9Neurol., Massachusetts Gen. Hosp., Boston, MA; 10Neurol., Harvard Med. Sch., Boston, MA

Object and grasp-type information in premotor and MI neurons during imitated actions

*J. B. ZIMMERMANN[1,2], J. HYNES[1], C. E. VARGAS-IRWIN[1], J. P. DONOGHUE[2,1]; 1Dept. of Neurosci., Brown Univ., Providence, RI; 2Wyss Ctr. For Bio and Neuro Engin., Geneva, Switzerland

Neural Control of movement Conference 2017, Dublin, Ireland

A Relational approach to identifying functionally linked neuronal sub-networks
Carlos Vargas-Irwin[1], Jonas Zimmermann[1], Jacqueline Hynes[1], John Donoghue[1] 1. Brown University Neuroscience Department

Diverging dynamical regimes in primate motor/premotor cortex reflect cue timing during grasping movement preparation
Jacqueline Hynes[1], Carlos Vagras-Irwin[1], Lachlan Franquemont[1], John Donoghue[1] 1. Brown University Neuroscience Department

Society for Neuroscience Annual Meeting 2016 Posters, San Diego, CA

Closed loop intracortical brain computer interface cursor control in people using a continuously updating gaussian process decoder

*D. BRANDMAN1,2, M. C. BURKHART3, T. HOSMAN4, J. SAAB4,2,7, A. A. SARMA4,7,2, D.J. MILSTEIN5, C. VARGAS-IRWIN6,2, B. FRANCO8, J. P. DONOGHUE6,4, M. T. HARRISON3, L. R. HOCHBERG7,4,8; 2Inst. for Brain Sci.,

3Applied Math, 4Sch. of Engin., 5Dept. of Comp. Sci., 6Neurosci., 1Brown Univ., Providence, RI; 7Ctr. for Neurorestoration and Neurotechnology, Rehab. R&D Service, Dept. of VA Med. Ctr., Providence, RI; 8Neurol., Massachusetts Gen. Hosp., Boston, MA

Evaluating force representation in motor cortex of intracortical BCI users with chronic tetraplegia

*A. RASTOGI1, B. A. MURPHY, 441061, F. R. WILLETT1, W. D. MEMBERG1, B. L. WALTER, 441062,4, J. P. MILLER3,5, J. A. SWEET3,5, C. E. VARGAS-IRWIN6,7, L. R. HOCHBERG8,9,10,7, R. F. KIRSCH1,11, A. B. AJIBOYE1,11;
1Biomed. Engin., Case Western Reserve Univ., Cleveland, OH; 2Neurol., 3Neurosurg., Univ. Hosp. Case Med. Ctr., Cleveland, OH; 4Neurol., 5Neurolog. Surgery, Case Western Reserve Univ. Sch. of Med., Cleveland, OH; 6Dept. of Neurosci., 7Inst. for Brain Sci., 8Sch. of Engin., Brown Univ., Providence, RI; 9Neurlogy, Massachusetts Gen. Hosp., Boston, MA; 10Neurol., Harvard Med. Sch., Boston, MA; 11FES Ctr. of Excellence, Rehabil. R&D Service, Louis Stokes Cleveland Dept. of VA Med. Ctr., Cleveland, OH

Neural Control of movement Conference 2016, Montego Bay, Jamaica
Linking Objects to Actions:Incorporating novel objects into existing neural templates

C.E. Vargas-Irwin[1], J.B. Zimmermann, M.J. Black[2], J.P. Donoghue[1]. [1]Neuroscience Department, Brown University, Providence, RI, [2]Max Planck Institute for Intelligent Systems, Tübingen, Germany, Computer Science Department, Brown University, Providence, RI

"Mirror neuron" activity reflects timing of actions more than object and grasp type

J.B. Zimmermann, C.E. Vargas-Irwin[1], M.J. Black[2], J.P. Donoghue[1]. [1]Neuroscience Department, Brown University, Providence, RI, [2]Max Planck Institute for Intelligent Systems, Tübingen, Germany, Computer Science Department, Brown University, Providence, RI

Society for Neuroscience Annual Meeting 2015 Posters, Chicago, IL
Decoding grip type from cortical ensemble activity in humans and non-human primates: Improving classification using training data bootstrapping

C. E. VARGAS-IRWIN[1], J. B. ZIMMERMANN[1,2], D. M. BRANDMAN[1,2], B. SORICE[4], C. H. BLABE[6,7], E. N. ESKANDAR[5], K. V. SHENOY[8,7,9,10,11], J. M. HENDERSON[6,7], S. S. CASH[4,12], M. J. BLACK[13], L. R. HOCHBERG[14,3,4,12,2], J. P. DONOGHUE[14,1,3,2];
[1]Dept. of Neurosci., [2]Inst. For Brain Sci., [3]Sch. of Engin., Brown Univ., Providence, RI; [4]Neurol., [5]Neurosurg., Massachusetts Gen. Hosp., Boston, MA; [6]Neurosurg., [7]Stanford Neurosciences Inst., [8]Electrical Engin., [9]Neurosciences Program, [10]Dept. of Neurobio., [11]Bioengineering, Stanford Univ., Stanford, CA; [12]Neurol., Harvard Med. Sch., Boston, MA; [13]Max Planck Inst. for Intelligent Systems, Tübingen, Germany; [14]Ctr. for Neurorestoration and Neurotechnology, Rehab. R&D Service, Dept. of VA Med. Ctr., Providence, RI

Neural ensemble activity characterizes sleep states, active movement, and movement observation in motor cortex
J. B. ZIMMERMANN[1,2], C. E. VARGAS-IRWIN[1,2], J. P. DONOGHUE[1,2,3,4]; [1]Dept. of Neurosci., [2]Inst. for Brain Sci., [3]Sch. of Engin., Brown Univ., Providence, RI; [4]Ctr. for Neurorestoration and Neurotechnology, Rehab. R&D Service, Dept. of VA Med. Ctr., Providence, RI

Identification of (~20 Hz) beta spatiotemporal dynamics in motor cortex LFPs
M. E. RULE, C. VARGAS-IRWIN, J. DONOGHUE, W. TRUCCOLO; Brown Univ., Providence, RI

Real-time 200 channel broadband neural data collection and analysis in an embedded mobile data processing system
J. KOMAR[1], C. HEELAN[1], C. E. VARGAS-IRWIN[2,3], J. D. SIMERAL[6,4,5], A. NURMIKKO[1]; [2]Dept. of Neurosci., [3]Inst. For Brain Sci., [4]Sch. of Engin., [5]Inst. for Brain Sci., [1]Brown Univ., Providence, RI; [6]Ctr. for Neurorestoration and Neurotechnology, Rehab R&D Service, Dept. of VA Med. Ctr., Providence, RI

Multiple grasp types can be reliably decoded from the precentral gyrus in people with ALS using implanted intracortical electrodes
D. BRANDMAN[1,2,3], J. SAAB[4,3], C. E. VARGAS-IRWIN[2,3], S. E. FASOLI[6,3,5], C. H. BLABE[7], B. SORICE[10], S. S. CASH[10,12], E. N. ESKANDAR[11], J. M. HENDERSON[7], K. V. SHENOY[8,9], B. JAROSIEWICZ[2,6,3], L. R. HOCHBERG[6,4,10,12,3]; [2]Neurosci., [3]Inst. for Brain Sci., [4]Engin., [5]Biol. and Med., [1]Brown Univ., Providence, RI; [6]Ctr. for Neurorestoration and Neurotechnology, Rehab R&D Service, Dept. of VA Med. Ctr., Providence, RI; [7]Neurosurg., [8]Electrical Engin., [9]Neurosci., Stanford Univ., Stanford, CA; [10]Neurol., [11]Neurosurg., Massachusetts Gen. Hosp., Boston, MA; [12]Neurol., Harvard Med. Sch., Boston, MA

Low dimensional dynamics of the primary motor cortex during natural locomotion captures kinematic information and improves decoding performance for brain machine interfaces
D. Y. XING[1], M. AGHAGOLZADEH[2], D. BRANDMAN[2,3], C. VARGAS-IRWIN[2], W. TRUCCOLO[2,4], D. BORTON[3,1]; [1]Sch. of Engin., [2]Dept of Neurosci., [3]Brown Inst. for Brain Sci., Brown Univ., Providence, RI; [4]Ctr. for Neurorestoration and Neurotechnology, DVA, Providence, RI

Society for Neuroscience Annual Meeting 2014 Posters, Washington, DC
Watch, Imagine, Attempt: Context-dependent decoding of movement direction in human motor cortex using spike train similarity analysis
C. E. VARGAS-IRWIN[1,2], J. FELDMAN[1,2], S. S. CASH[4,6], E. N. ESKANDAR[5], G. FRIEHS[7], K. NEWELL[4], L. R. HOCHBERG[8,3,4,6,2], J. P. DONOGHUE[8,1,3,2]; [1]Dept. of Neurosci., [2]Inst. For Brain Sci., [3]Sch. of Engin., Brown Univ., Providence, RI; [4]Neurol., [5]Neurosurg., Massachusetts Gen. Hosp., Boston, MA; [6]Neurol., Harvard Med. Sch., Boston, MA; [7]Neurosurg., Scott & White Hospital, A&M University , Temple, TX; [8]Ctr. for Neurorestoration and Neurotechnology, Rehab.

R&D Service, Dept. of VA Med. Ctr., Providence, RI

Identifying MI/PMv neural ensemble states associated with motor errors using spike train similarity analysis

T. C. WHALEN[1], C. E. VARGAS-IRWIN[2,3], J. P. DONOGHUE[5,2,4,3]; [2]Dept. of Neurosci., [3]Inst. for Brain Sci., [4]Sch. of Engin., [1]Brown Univ., Providence, RI; [5]Ctr. for Neurorestoration and Neurotechnology, Rehab. R&D Service, Dept. of VA Med. Ctr., Providence, RI

Optogenetically-induced spatiotemporal gamma oscillations and neuronal spiking activity in primate motor cortex

Y. LU[1], W. TRUCCOLO[2,3,5], C. E. VARGAS-IRWIN[2,3], I. OZDEN[4], J. B. ZIMMERMANN[2,3], T. MAY[4], F. WAGNER[2], A. V. NURMIKKO[4,3]; [2]Neurosci., [3]Inst. for Brain Sci., [4]Engin., [1]Brown Univ., Providence, RI; [5]DVA, Ctr. for Neurorestoration and Neurotechnology, Providence, RI

Society for Neuroscience Annual Meeting 2013 Poster, San Diego, CA
Target object, but not grip type, is represented in motor cortex during action observation

J.B. Zimmermann, C.E. Vargas-Irwin[1], M.J. Black[2], J.P. Donoghue[1]. [1]Neuroscience Department, Brown University, Providence, RI, [2]Max Planck Institute for Intelligent Systems, Tübingen, Germany, Computer Science Department, Brown University, Providence, RI

Neural Control of Movement Annual Conference 2013 Poster, San Juan, PR
Temporal sequencing of instruction cues changes movement related activity in primate primary motor and ventral premotor cortex

Lachlan Franquemont1, Carlos Vargas-Irwin1, Michael Black2, John Donoghue1

Neural Control of Movement Annual Conference 2012 Poster, Venice, Italy
Evolution of grip and object representations in the MI-PMv circuit: A neural trajectory analysis

C.E. Vargas-Irwin[1], L. Franquemont[1], M.J. Black[2], J.P. Donoghue[1]. [1]Neuroscience Department, Brown University, Providence, RI, [2]Max Planck Institute for Intelligent Systems, Tübingen, Germany, Computer Science Department, Brown University, Providence, RI

Neural Control of Movement Annual Conference 2011 Poster, San Juan, PR
Separation of Visual Object Features and Grasp Strategy in Primate Ventral Premotor Cortex.

C.E. Vargas-Irwin[1], L. Franquemont[1], M.J. Black[2], J.P. Donoghue[1]. [1]Neuroscience Department, Brown University, Providence, RI, [2]Max Planck Institute for Intelligent Systems, Tübingen, Germany, Computer Science Department, Brown University, Providence, RI

Society for Neuroscience Annual Meeting 2010 Posters, San Diego, CA
Reach to grasp actions in rhesus macaques: Dimensionality reduction of hand, wrist, and upper arm motor subspaces. C.E. Vargas-Irwin[1], L. Franquemont[1], G. Shakhnarovich[3], P. Yadollahpour[3], M.J. Black[2], J.P. Donoghue[1]. 1Neurosci. Dept., 2Computer Sci. Dept., Brown Univ., Providence, RI; 3Toyota Technological Inst., Chicago, IL

Decoding continuous and discrete states in 3-D reaching and grasping movements from local field potentials in monkey primary motor cortex J. Zhuang[1], W. Truccolo[2], C. Vargas-Irwin, J. P. Donoghue[2];
1Biomed. Engin., Shanghai Jiao Tong Univ., Shanghai, China; 2Neurosci., Brown Univ., Providence, RI.

Decoding 3-D reach and grasp kinematics from multi-scale spatiotemporal neural activity in primary motor and ventral premotor cortex. A. K. Bansal[1,2], W. Truccolo[2,3,4], C.E. Vargas-Irwin[2],
J.P. Donoghue[2,5,3];
1Brown Univ., Providence, RI; 2Neurosci., 3Brown Inst. for Brain Sci., Brown Univ., Providence, RI; 4Neurol., Massachusetts Gen. Hosp., Boston, MA; 5Rehab R&D Service, Veterans Affairs Med. Ctr., Providence, RI

Society for Neuroscience Annual Meeting 2009 Presentation, Chicago, IL
Neuroprosthetics I Nanosymposium:

Evaluating the potential of primary motor and premotor cortex for multidimensional neuroprosthetic control of reaching and grasping actions Vargas-Irwin CE, Yadollahpour P, Shakhnarovich G, Black MJ, Donoghue JP.
Program No. 14.7.

Society for Neuroscience Annual Meeting 2008 Posters, Washington, DC
Reconstructing Reach and Grasp Actions Using Neural Population Activity from Primary Motor Cortex. Vargas-Irwin CE, Yadollahpour P, Shakhnarovich G, Black MJ, Donoghue JP. Program No. 673.18.

Slow-wave local field potentials related to repeated hand movements in primate primary motor cortex and ventral premotor cortex. Bansal AK, Vargas-Irwin CE, Donoghue JP. Program No. 182.20.

Decoding of reach and grasp from MI population spiking activity using a low-dimensional model of hand and arm posture. Yadollahpour P, Shakhnarovich G, Vargas-Irwin C, Donoghue JP. Program No. 673.20.

Society for Neuroscience Annual Meeting 2007 Poster, San Diego, CA
Neural Correlates of Grip Aperture in Primary Motor Cortex. Vargas-Irwin CE, Artemiadis PK, Shakhnarovich G, Black MJ, Donoghue JP. Program No. 517.10.

Society for Neuroscience Annual Meeting 2005 Posters, Washington, DC
Effects of a short series of repetitive movements on directional tuning in Primary motor Cortex and Parietal Cortex. Vargas-Irwin C, Philip, BA, Donoghue J.P. Program No. 981.3. 2005 Washington DC: Society for Neuroscience.

M1-5d statistical interdependencies via dual multielectrode array recordings. Truccolo W, Vargas-Irwin C, Philip BA, Donoghue JP Program No. 981.13.

Society for Neuroscience Annual Meeting 2004 Posters, San Diego, CA
Long - term intracortical recording with multielectrode arrays in primates: Histological responses and recording. Donoghue JP, Fellows MR, Vargas-Irwin C, Travers BA, Suner S. Program No. 421.10.

Spatial-temporal propagation of learned-movement-related neuronal activity in the arm area of motor cortex in nonhuman primates. Suner S, Shaikhouni A, Vargas-Irwin C, Fellows M, Donoghue JP. Program No. 190.10.

Society for Neuroscience Annual Meeting 2003 Posters, New Orleans, LA
Accuracy of Manual Spike Sorting: Results for the Utah Intracortical Array. Wood F, M. R. Fellows MR, Vargas-Irwin C, Black M, J.P. Donoghue JP. Program No. 279.2.

Stability of Neural Signals from Bionic 100-electrode Array implanted in Primate Motor Cortex. Suner S, Fellows MR, Vargas-Irwin C, Donoghue JP. Program No. 607.12. 2003.

Society for Neuroscience Annual Meeting 2002 Poster, Orlando, FL
Interplay between Fine Temporal and Rate Based Neural Codes in M1 and SMA. Vargas-Irwin C, Hatsopoulos NG, Donoghue, JP. Program No. 357.4. 2002