

# Jose M. Carmena

## *Curriculum Vitae\**

### Current Position

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Chancellor's Professor of Electrical Engineering and Neuroscience  
Department of Electrical Engineering and Computer Sciences  
Helen Wills Neuroscience Institute  
University of California, Berkeley  
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Co-Director  
Center for Neural Engineering and Prosthesis (CNEP) at UC Berkeley and UC San Francisco  
<http://www.cnep-uc.org>

### Research Interests

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- ❖ **Systems & Cognitive Neuroscience:** large-scale neural circuit dynamics during learning; neural mechanisms of action; motor control; neuroplasticity.
- ❖ **Neural Engineering:** brain-machine interfaces; algorithms for closed-loop decoder adaptation; neuroprosthetic systems; neural ensemble computation.

### Higher Education and Training

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Postdoctoral fellow	Neurobiology Duke University, Durham, NC (USA)	2002-2005
Ph.D.	Robotics University of Edinburgh (UK)	2002
M.S.	Artificial Intelligence University of Edinburgh (UK)	1998
M.S.	Electrical Engineering University of Valencia (Spain)	1997
B.S.	Electrical Engineering Polytechnic University of Valencia (Spain)	1995

(\*) Last updated November 18<sup>th</sup>, 2017.

## Positions and Employment

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Professor	Dept. of Electrical Engineering & Computer Sciences; Helen Wills Neuroscience Institute University of California, Berkeley, CA, (USA)	since 07/2015
Associate Professor	Dept. of Electrical Engineering & Computer Sciences; Helen Wills Neuroscience Institute University of California, Berkeley, CA, (USA)	07/2011 – 06/2015
Co-Director	Center for Neural Engineering and Prosthesis UC Berkeley and UC San Francisco, CA, (USA)	since 12/2010
Assistant Professor	Dept. of Electrical Eng. & Comp. Sciences; Cog. Science; Helen Wills Neurosc. Institute University of California, Berkeley, CA, (USA)	07/2005 – 06/2011
Postdoctoral Fellow	Dept. of Neurobiology, Center for Neuroeng. Duke University, Durham, NC, (USA)	02/2002 – 07/2005
Lecturer	Division of Informatics University of Edinburgh (UK)	09/2001 – 02/2002
Teaching Assistant	Division of Informatics University of Edinburgh (UK)	10/1998 – 06/2001
Visiting researcher	Department of Artificial Intelligence University of Edinburgh (UK)	06/1996 – 09/1996
Research assistant	Robotics Institute University of Valencia (Spain)	10/1995 – 09/1997

## Honors and Awards

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- ❖ McKnight Technological Innovations in Neuroscience Award, 2017
- ❖ Fellow, Institute of Electrical and Electronics Engineers, 2017
- ❖ Sackler Sabbatical Exchange Program Award, University of California, Berkeley, 2016
- ❖ Chancellor's Professorship, University of California, Berkeley, 2015
- ❖ Bakar Fellow, University of California, Berkeley, 2012
- ❖ Early Career Achievement Award, IEEE Engineering in Medicine and Biology Society, 2011
- ❖ Aspen Brain Forum Prize in Neurotechnology, The New York Academy of Sciences, 2010
- ❖ National Science Foundation CAREER Award, 2010
- ❖ Sloan Research Fellow in Neuroscience, Alfred P. Sloan Foundation, 2009
- ❖ Distinguished Lecturer, IEEE Systems, Man and Cybernetics Society, 2009-2012
- ❖ Christopher and Dana Reeve Foundation Fellowship, 2007

- ❖ Okawa Foundation Research Award, 2007
- ❖ Hellman Family Faculty Fund Award, University of California, Berkeley, 2007
- ❖ Esquire Magazine, Best and Brightest, 2004
- ❖ Christopher Reeve Paralysis Foundation Postdoctoral Fellowship, 2003
- ❖ PhD-Scholarship, EU TMR-Network SMART2, 1998–2001
- ❖ MSc-Scholarship, Student Awards Agency of Scotland, (UK), 1997–1998
- ❖ Suma Cum Laude, University of Valencia (Spain), 1997

## Professional Memberships

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- 2017 Fellow, Institute of Electrical and Electronics Engineers
- 2009 Senior member, Institute of Electrical and Electronics Engineers
- 2005 Member, Society for the Neural Control of Movement
- 2002 Member, Society for Neuroscience
- 1997 Member, Institute of Electrical and Electronics Engineers

## Scientific Advisory Boards, Technical Committees, Steering Committees

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- 2015 - present Member, SAB, Center for Neuro-Electronics Research Flanders (NERF), Belgium
- 2014 - present Chair, SAB, Center for Sensorimotor Neural Engineering, Univ. of Washington, Seattle, WA
- 2014 - present Member, SC, International Conference on Neurorehabilitation (ICNR)
- 2013 - present Member, SC, Neural Interfaces Conference (NIC)
- 2009 - present Member, TC, Brain-Machine Interface Systems – IEEE Systems, Man, and Cybernetics Society
- 2009 - 2011 Chair, TC, Brain-Machine Interface Systems – IEEE Systems, Man, and Cybernetics Society
- 2014 - present Co-Chair, IEEE-EMBS Advanced NeuroTechnologies for Brain Initiatives (ANTBI) Workshop
- 2015 - present Vice Chair, IEEE BRAIN Initiative
- 2016 - present Vice Chair, TC, Neuroengineering – IEEE Engineering in Medicine and Biology Society
- 2009 - present Member, TC, Neuroengineering – IEEE Engineering in Medicine and Biology Society

## Editorial Boards

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- 2015 - present Associate Editor, IEEE Transactions on Biomedical Engineering
- 2014 - present Associate Editor, eNeuro – Society for Neuroscience
- 2014 - present Associate Editor, Frontiers for Young Minds
- 2009 - 2012 Associate Editor, IEEE Transactions on System, Man, and Cybernetics, part B
- 2009 - 2012 Associate Editor, IEEE Transactions on System, Man, and Cybernetics, part A

## Publications

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### Journal Articles

1. Santacruz S.R., Rich E.L., Wallis J.D., and **Carmena J.M.** (2017) Caudate microstimulation increases value of specific choices. **Current Biology Online Now** DOI: <http://dx.doi.org/10.1016/j.cub.2017.09.051>.
2. Yuste R., Goering S., Agüera y Arcas B., Bi G., **Carmena J.M.**, et al. (2017) Four ethical priorities for neurotechnologies and AI. **Nature** 551(7679), pp. 159-163.
3. Khanna P. and **Carmena J.M.** (2017) Beta band oscillations in motor cortex reflect neural population signals that delay movement onset. **eLife** 6:e24573 DOI: 10.7554/eLife.24573.
4. Athalye V.R., Ganguly K., Costa R.M.\*, and **Carmena J.M.\*** (2017) Emergence of coordinated neural dynamics underlies neuroprosthetic learning and skillful control. **Neuron** 93(4):955-970.e5. doi: 10.1016/j.neuron.2017.01.016.
5. Shanechi M.M.\*, Orsborn A.L.\*, Moorman H.G.\*, Gowda S.\*, Dangi S, and **Carmena J.M.** (2017) Rapid control and feedback rates in the sensorimotor pathway enhance neuroprosthetic control. **Nature Communications** 8:13825, DOI: 10.1038/ncomms13825.
6. Khanna, P., Swann, N.C., de Hemptinne, C., Miocinovic, M., Miller, A., Starr, P.A. and **Carmena, J.M.** (2016) Neurofeedback control in Parkinsonian patients using electrocorticography signals accessed wirelessly with a chronic, fully implanted device. **IEEE Transactions on Neural Systems and Rehabilitation Engineering** (in press).
7. Moorman H.G.\*, Gowda S.\* and **Carmena J.M.** (2016) Control of redundant kinematic degrees of freedom in a closed-loop brain-machine interface. **IEEE Transactions on Neural Systems and Rehabilitation Engineering** (in press).
8. Seo D.J.\*, Neely R.M.\*, Shen K., Singhal U., Alon E., Rabaey J.M., **Carmena J.M.\*** and Maharbiz M.M.\* (2016) Wireless recording in the peripheral nervous system with ultrasonic neural dust. **Neuron** 91, pp. 529-539.
9. Shanechi M.M.\*, Orsborn A.L.\* and **Carmena J.M.** (2016) Robust brain-machine interface design using optimal feedback control modeling and adaptive point process filtering. **PLoS Computational Biology** 12(4):e1004730.doi: 10.1371/journal.pcbi.1004730.
10. Lu J., Haninger K., Chen W., Gowda S., Tomizuka M. and **Carmena J.M.** (2016) Design of a passive upper limb exoskeleton for macaque monkeys. **Journal of Dynamic Systems, Measurement, and Control** 138(11) DS-15-1619; doi: 10.1115/1.4033837.
11. Overduin S.A., d'Avella A., Roh J., **Carmena J.M.\***, Bizzi E.\* (2015) Cortical representation of muscle synergies in the primate brain. **Journal of Neuroscience** 35(37), pp. 12615-12624; doi: 10.1523/JNEUROSCI.4302-14.2015
12. Gowda S., Overduin S.A., Chen M., Chang Y-H., Tomlin C.J. and **Carmena J.M.** (2015) Accelerating submovement decomposition with search space reduction heuristics. **IEEE Transactions on Biomedical Engineering** 62(10), pp. 2508-2515.
13. Chang Y-H., Korkola J., Amin D.N., Moasser M., **Carmena J.M.**, Gray J.W. and Tomlin C.J. (2015) Disentangling multidimensional spatiotemporal data into their common and aberrant responses, **PLoS One** 10(4): e0121607. doi: 10.1371/journal.pone.0121607.

14. Muller R., Le H.-P., Li W., Ledochowitsch P., Gambini S., Björninen T., Koralek A., **Carmena J.M.**, Maharbiz M.M., and Rabaey J.M. (2015) A minimally invasive 64-channel wireless  $\mu$ ECoG implant. **IEEE Journal of Solid-State Circuits** 50(1), pp. 344-359. doi:10.1109/JSSC.2014.2364824.
15. Moradi E., Amendola S., Björninen T., Sydänheimo L., **Carmena J.M.**, Rabaey J.M., Ukkonen L. (2015) Backscattering neural tags for wireless brain-machine interface systems. **IEEE Transactions on Antennas and Propagation** 63(2), pp. 719-726.
16. Seo D.J., **Carmena J.M.**, Rabaey J.M., Maharbiz M.M. and Alon E. (2014) Model validation of untethered, ultrasonic neural dust motes for cortical recording. **Journal of Neuroscience Methods** 244, pp. 114-22. doi: 10.1016/j.jneumeth.2014.07.025.
17. Orsborn A.L., Moorman H.G., Overduin S.A., Shanechi M.M., Dimitrov D.F. and **Carmena J.M.** (2014) Closed-loop decoder adaptation shapes neural plasticity for skillful neuroprosthetic control. **Neuron** 82, pp. 1380-1393.
18. Clancy K.B.\*, Koralek A.C.\*, Costa R.M., Feldman D.E. and **Carmena J.M.** (2014) Volitional modulation of optically recorded calcium signals during neuroprosthetic learning. **Nature Neuroscience** 17(6), pp. 807-810.
19. Dangi S., Gowda S., Moorman H.G., Orsborn A.L., So K., Shanechi M. and **Carmena J.M.** (2014) Continuous closed-loop decoder adaptation with a recursive maximum likelihood algorithm allows for rapid performance acquisition in brain-machine interfaces. **Neural Computation** 12, pp. 1-29.
20. Gowda S., Orsborn A.L., Overduin S.A., Moorman H.G. and **Carmena J.M.** (2014) Designing dynamical properties of brain-machine interfaces to optimize task-specific performance. **IEEE Transactions on Neural Systems and Rehabilitation Engineering** 99, 10.1109/TNSRE.2014.2309673.
21. So K.\*, Dangi S.\*, Orsborn A.L., Gastpar M.C., **Carmena J.M.** (2014) Subject-specific modulation of local field potential spectral power during brain-machine interface control in primates. **Journal of Neural Engineering** 11, 026002 doi:10.1088/1741-2560/11/2/026002.
22. Overduin S.A., d'Avella A., **Carmena J.M.**, Bizzi E. (2014) Muscle synergies evoked by microstimulation are preferentially encoded during behavior. **Frontiers in Computational Neuroscience** 8:20. doi: 10.3389/fncom.2014.00020.
23. Moradi E., Björninen T., Sydänheimo L., **Carmena J.M.**, Rabaey J.M. and Ukkonen L. (2013) Measurement of wireless link for brain-machine interface systems using human head equivalent liquid. **IEEE Antennas and Wireless Propagation Letters**, 12, pp. 1307-1310.
24. Koralek A.C., Costa R.M. and **Carmena J.M.** (2013) Temporally precise cell-specific coherence develops in corticostriatal networks during learning. **Neuron** 79(5), pp. 865-872.
25. Buddha S.K., So K., **Carmena J.M.** and Gastpar M.C. (2013) Function identification in neuron populations via information bottleneck. **Entropy** 15, pp. 1587-1608; doi:10.3390/e15051587.
26. Long J.D. and **Carmena J.M.** (2013) Dynamic changes of rodent somatosensory barrel cortex are correlated with learning a novel conditioned stimulus. **Journal of Neurophysiology** 109(10), pp. 2585-2595.

27. Dangi D.\*, Orsborn A.L.\*, Moorman H.G. and **Carmena J.M.** (2013) Design and analysis of closed-loop decoder adaptation algorithms for brain-machine interfaces. **Neural Computation** 25, 1693–1731.
28. Biederman W., Yeager D., Narevsky N., Koralek A., **Carmena J.M.**, Alon E. and Rabaey J. (2013) A fully-integrated, miniaturized (0.125mm<sup>2</sup>) 10.5\_uW wireless neural sensor. **IEEE Journal of Solid-State Circuits** 48(4), pp. 960-970.
29. Overduin S.A., d'Avella A., **Carmena J.M.** and Bizzi E. (2012) Microstimulation activates a handful of muscle synergies. **Neuron** 76(6), pp. 1071-1077.
30. Canolty R.T., Ganguly K. and **Carmena J.M.** (2012) Task-dependent changes in cross-level coupling between single neurons and multi-scale network activity. **PLoS Computational Biology** 8(12): e1002809. doi:10.1371/journal.pcbi.1002809. [*Commentary: Womelsdorf T., Westendorff S., and Ardid S. Subnetwork selection in deep cortical layers is mediated by beta-oscillation dependent firing (2013) Frontiers in Systems Neuroscience, 7: 25.*]
31. Koralek A.C.\*, Jin X.\*, Long J.D., Costa R.M. and **Carmena J.M.** (2012) Corticostriatal plasticity is necessary for learning intentional neuroprosthetic skills. **Nature** 483(7389), pp. 331-335. [*News and Views: Blake D.T. (2012) How brains learn to control machines. Nature 483(7389), pp. 284-285.*]
32. Canolty R.T., Cadieu C.F., Koepsell K., Ganguly K., Knight R.T. and **Carmena J.M.** (2012) Detecting event-related changes of multivariate phase coupling in dynamic brain networks. **Journal of Neurophysiology** 107(7), pp. 2020-2031.
33. Orsborn A.L., Dangi S., Moorman H.G. and **Carmena J.M.** (2012) Closed-loop decoder adaptation on intermediate time-scales facilitates rapid BMI performance improvements independent of decoder initialization conditions. **IEEE Transactions on Neural Systems and Rehabilitation Engineering** doi: 10.1109/TNSRE.2012.2185066.
34. So K., Koralek A.C., Ganguly K., Gastpar M.C. and **Carmena J.M.** (2012) Assessing functional connectivity of neural ensembles using directed information. **Journal of Neural Engineering** 9(2):026004 doi:10.1088/1741-2560/9/2/02600.
35. Canolty R.T., Cadieu C.F., Koepsell K., Knight R.T. and **Carmena J.M.** (2012) Multivariate phase-amplitude cross-frequency coupling in neurophysiological signals. **IEEE Transactions on Biomedical Engineering** 59(1), pp. 8-11.
36. So K., Ganguly K., Jimenez J., Gastpar M., and **Carmena J.M.** (2011) Redundant information encoding in primary motor cortex during natural and neuroprosthetic control. **Journal of Computational Neuroscience** doi: 10.1007/s10827-011-0369-1.
37. Long J.D. and **Carmena J.M.** (2011) A statistical description of neural ensemble dynamics. **Frontiers in Computational Neuroscience** 5:52. doi: 10.3389/fncom.2011.00052.
38. Ganguly K., Wallis J.D. and **Carmena J.M.** (2011) Reversible large-scale modification of cortical networks during neuroprosthetic control. **Nature Neuroscience** 14, pp. 662-667. [*Faculty of 1000, 'Recommended'*]
39. Venkatraman S. and **Carmena J.M.** (2011) Active sensing of target location encoded by cortical microstimulation. **IEEE Transactions on Neural Systems and Rehabilitation Engineering** doi: 10.1109/TNSRE.2011.2117441.
40. Venkatraman S., Hendricks J., Richardson-Burns S., Jan E., Martin D.C. and **Carmena J.M.** (2011) *In vitro* and *in vivo* evaluation of PEDOT microelectrodes for neural stimulation and

recording **IEEE Transactions on Neural Systems and Rehabilitation Engineering** doi: 10.1109/TNSRE.2011.2109399.

41. Canolty R.T., Ganguly K., Kennerley S.W., Cadieu C.F., Koepsell K., Wallis J.D. and **Carmena J.M.** (2010) Oscillatory phase coupling coordinates anatomically-dispersed functional cell assemblies. **Proceedings of the National Academy of Sciences** 107(40), pp.17356-17361.
42. Venkatraman S., Jin X., Costa R.M. and **Carmena J.M.** (2010) Using inertial sensors to investigate neural correlates of behavior in freely behaving rodents. **Journal of Neurophysiology** 104, pp. 569-575.
43. Ganguly K. and **Carmena J.M.** (2010) Neural correlates of skill acquisition with a cortical brain-machine interface. **Journal of Motor Behavior** 42(6), pp. 355-360.
44. Heliot R., Ganguly K., Jimenez J. and **Carmena J.M.** (2010) Learning in closed-loop brain-machine interfaces: modeling and experimental validation. **IEEE Transactions on Systems, Man and Cybernetics, part B** 40(5), pp. 1387-1397.
45. Heliot R., Orsborn A., Ganguly K. and **Carmena J.M.** (2010) System architecture for stiffness control in brain-machine interfaces. **IEEE Transactions on Systems, Man and Cybernetics, part A** 40(4), pp. 732-742.
46. Ganguly K., Secundo L., Ranade G., Orsborn A., Chang E.F., Dimitrov D.F., Wallis J.D., Barbaro N.M., Knight R.T. and **Carmena J.M.** (2009) Cortical representation of ipsilateral arm movements in monkey and man. **Journal of Neuroscience**, 29: 12948 – 12956.
47. Ganguly K. and **Carmena J.M.** (2009) Emergence of a stable cortical map for neuroprosthetic control. **PLoS Biology** 7(7), e1000153.doi:10.1371/journal.pbio.1000153. [*Faculty of 1000, 'Must Read'*]
48. Venkatraman S. and **Carmena J.M.** (2009) Behavioral modulation of stimulus-evoked oscillations in barrel cortex of alert rats. **Frontiers in Integrative Neuroscience** 3:10. doi:10.3389/neuro.07.010.2009 [*Comentary: Tort ABL and Katz DB (2010) Oscillations trumped by behavior: a link between sensory and direct electrical stimulation of cortical activity. Front. Neurosci. 4:39. doi: 10.3389/fnins.2010.00039*]
49. Venkatraman S., Long J.D., Elkabany K., Yao Y. and **Carmena J.M.** (2009) A system for neural recording and closed-loop intracortical microstimulation in awake rodents. **IEEE Transactions on Biomedical Engineering** 56(1), pp. 15-22.
50. Kim H.K., **Carmena J.M.**, Biggs S.J., Hanson T.L., Nicolelis M.A.L. and Srinivasan M.A. (2007) The muscle activation method: An approach to impedance control of brain-machine interfaces through a musculoskeletal model of the arm. **IEEE Transactions on Biomedical Engineering** 54(8), pp. 1520-1529.
51. Zacksenhouse M., Lebedev M.A., **Carmena J.M.**, O'Doherty J.E., Henriquez C.S. and Nicolelis M.A.L. (2007) Cortical modulations increase in early sessions with brain-machine interface. **PLoS One** 7, e619.
52. Kim S.-P., Sanchez J.C., Rao Y.N., Erdogmus D., **Carmena J.M.**, Lebedev M.A., Nicolelis M.A.L. and Principe J.C. (2006) A comparison of optimal MIMO linear and nonlinear models for brain-machine interfaces. **Journal of Neural Engineering** 3, pp. 145-161.
53. Kim H.K., Biggs S.J., Schloerb D.W., **Carmena J.M.**, Lebedev M.A., Nicolelis M.A.L. and Srinivasan M.A. (2006) Continuous shared control stabilizes reach and grasping with

- brain-machine interfaces. **IEEE Transactions on Biomedical Engineering** 53(6), pp. 1164-1173.
54. Gutierrez R., **Carmena J.M.**, Nicolelis M.A.L. and Simon S.A. (2006) Temporal specific ensembles of rat orbitofrontal neurons represent the drinking of liquid rewards. **Journal of Neurophysiology** 95, pp. 119-133.
  55. **Carmena J.M.**, Lebedev M.A., Henriquez C.S. and Nicolelis M.A.L. (2005) Stable ensemble performance with single neuron variability during reaching movements in primates. **Journal of Neuroscience** 25(46):10712-10716.
  56. Lebedev M.A., **Carmena J.M.**, O'Doherty J.E., Zacksenhouse M., Henriquez C.S., Principe J.C. and Nicolelis M.A.L. (2005) Cortical ensemble adaptation to represent velocity of an artificial actuator controlled by a brain-machine interface. **Journal of Neuroscience** 25(19):4681-4693.
  57. **Carmena J.M.** and Hallam J.C.T. (2004) Narrowband tracking using a biomimetic sonarhead. **Robotics and Autonomous Systems** 46(4), pp. 247-259.
  58. Patil P.G., **Carmena J.M.**, Nicolelis M.A.L. and Turner D.A. (2004) Ensembles of human subcortical neurons as a source of motor control signals for a brain-machine interface. **Neurosurgery** 55(1), pp. 27-38.
  59. Sanchez J.C., **Carmena J.M.**, Lebedev M.A., Nicolelis M.A.L., Harris J.G. and Principe J.C. (2004) Ascertaining the importance of neurons to develop better brain-machine interfaces, **IEEE Transactions on Biomedical Engineering** 51(6), pp. 943-953.
  60. Bossetti C.A., **Carmena J.M.**, Nicolelis M.A.L. and Wolf P.D. (2004) Transmission latencies in a telemetry-linked brain-machine interface. **IEEE Transactions on Biomedical Engineering** 51(6), pp. 919-924.
  61. **Carmena J.M.** and Hallam J.C.T. (2004) The use of Doppler in Sonar-based mobile robot navigation: inspirations from Biology. **Information Sciences** 161(1-2), pp. 71-94.
  62. **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 Nicolelis M.A.L. (2003) Learning to control a brain-machine interface for reaching and grasping by primates. **PLoS Biology** 1(2), pp. 193-208.
  63. Nicolelis M.A.L., Dimitrov D., **Carmena J.M.**, Crist R.E., Lehew G., Kralik J. and Wise S.P. (2003) Chronic, multi site, multi electrode recordings in macaque monkeys. **Proceedings of the National Academy of Sciences** 100(19), pp. 11041-11046.
  64. **Carmena J.M.** and Hallam J.C.T. (2002) Estimating Doppler-shift using Bat-inspired Cochlear Filterbank Models: A Comparison of Methods for Echoes from Single and Multiple Reflectors. **Adaptive Behavior**. 9(3-4), pp.241-261.
  65. **Carmena J.M.**, Kämpchen N., Kim D., and Hallam J.C.T. (2001) Artificial ears for a biomimetic sonarhead: from multiple reflectors to surfaces. **Artificial Life**, 7(2), pp.147-169.

### **Review Articles, Position Papers, Book Chapters and Editorials**

1. Khanna P. and **Carmena J.M.** (2015). Neural oscillations: beta band activity across motor networks. *Current Opinion in Neurobiology* 32C, pp. 60-67.
2. Seo D.J., **Carmena J.M.**, Rabaey J.M., Alon E. and Maharbiz M.M. (2014) Neural dust:



- an untethered approach to chronic brain-machine interfaces. Marcus, Gary, and Jeremy Freeman, eds. *The Future of the Brain: Essays by the World's Leading Neuroscientists*. Princeton University Press.
3. Shenoy K.V. and **Carmena J. M.** (2014). Combining decoder design and neural adaptation in brain-machine interfaces. **Neuron** 84(4), pp. 665-680.
  4. **Carmena J. M.** and Millán J. R. (2013). Brain-machine interfaces: your brain in action. **Frontiers for Young Minds**. 1:7. doi: 10.3389/frym.2013.00007
  5. Moradi E., Koski K., Björninen T., Sydänheimo L., Rabaey J.M., **Carmena J.M.**, Rahmat-Samii Y. and Ukkonen L. (2014) Miniature implantable and wearable on-body antennas: towards the new era of wireless body-centric systems. **IEEE Antennas and Propagation Magazine**.
  6. Orsborn A.L. and **Carmena J.M.** (2013) Functional Neuroscience: Cortical Control of Limb Prosthesis. In: Jaeger D., Jung R. (Ed.) **Encyclopedia of Computational Neuroscience**. Springer-Verlag Berlin Heidelberg. doi: 10.1007/SpringerReference\_348570 2013-09-03 08:10:31
  7. Seo D.J., **Carmena J.M.**, Rabaey J.M., Alon E. and Maharbiz M.M. (2013) Neural Dust: an ultrasonic, low power solution for chronic brain-machine interfaces. **arXiv:1307.2196 [q-bio.NC]**
  8. Orsborn A.L. and **Carmena J.M.** (2013) Creating new functional circuits for action via brain-machine interfaces. **Frontiers in Computational Neuroscience** 7:157. doi: 10.3389/fncom.2013.00137.
  9. Marblestone A.H., Zamft B.M., Maguire Y.G., Shapiro M.G., Cybulski T.R., Glaser J.I., Amodei D., Stranges P.B., Kalhor R., Dalrymple D.A., Seo D., Alon E., Maharbiz M.M., **Carmena J.M.**, Rabaey J.M., Boyden E.S., Church G.M., Kording K.P. (2013) Physical principles for scalable neural recording. **Frontiers in Computational Neuroscience** 7:137. doi: 10.3389/fncom.2013.00137. (*published also as arXiv:1306.5709 [q-bio.NC]*)
  10. **Carmena J.M.** (2013) Advances in neuroprosthetic learning and control. **PLoS Biology** 11(5), e1001561. doi:10.1371/journal.pbio.1001561.
  11. **Carmena J.M.** (2012) Becoming Bionic. **IEEE Spectrum**, 49(3), pp. 24-29. [Online version appeared as 'How to control a prosthesis with your mind'].
  12. Sanchez J.C., Lytton W.W., **Carmena J.M.**, Principe J.C., Fortes, J., Barbour R.L. and Francis J.T. (2012) Dynamically repairing and replacing neural networks: using hybrid computational and biological tools. **IEEE Pulse**, 3(1), pp. 57-59.
  13. **Carmena J.M.** and Cohen L.G. (2012) Brain-machine interfaces and transcranial stimulation – future implications for spinal injury in humans. **Spinal Cord Injuries: Handbook of Clinical Neurology**, 109:435-44. 3<sup>rd</sup> edition. M.J. Aminoff et al. editors, Elsevier.
  14. Millan J.R. and **Carmena J.M.** (2010) Conversations in BME – invasive or noninvasive: understanding brain-machine interface technology. **IEEE Engineering in Medicine and Biology Magazine**, 29(1), pp. 16-22.
  15. Heliot R. and **Carmena J.M.** (2010) Brain-machine interfaces. **Encyclopedia of Behavioral Neuroscience**, In: Koob G.F., Le Moal M. and Thompson R.F. (eds.) *Encyclopedia of Behavioral Neuroscience*, volume 1, pp. 221–225 Oxford: Academic Press.

16. Micera S. and **Carmena J.M.** (2009) Editorial: Developing the Next Generation of Hybrid Neuroprosthetic Systems. **IEEE Transactions on Biomedical Engineering** 56(1), pp. 3-5.
17. **Carmena J.M.** (2008) Cortical control of neuroprosthetic devices. **Wearable robots: biomechatronic exoskeletons**, pp. 115-118. J.L. Pons editor. John Wiley and Sons.
18. **Carmena J.M.** and Nicolelis M.A.L. (2005) Advances in Brain-Machine Interfaces. **Motor Cortex in Voluntary Movements**, pp. 349-366, A. Riehle and E. Vaadia (Eds.), CRC Press.
19. **Carmena J.M.** (2005) Brain-machine interfaces: a novel paradigm for the study of learning and adaptation. **Artificial Intelligence and Simulation of Behaviour Quarterly**, 122, pp. 3-4.
20. **Carmena J.M.** (2004) Brain Versus Machine Control. **PLoS Biology** 2(12), pp.5-6, e430.
21. **Carmena J.M.** (2001) Report of the IROS 2000 conference. **Artificial Intelligence and Simulation of Behaviour Quarterly**, 105, pp.11-12, ISSN 0268 4179.
22. **Carmena J.M.** and Domingo J. (1998). Artificial Intelligence: A panoramic view. **Boletín de Psicología**, 59, pp. 21-47. ISSN 0212 8179.

### **Peer-Reviewed Conference Proceedings**

1. Khanna P., Athalye V., Costa R.M. and **Carmena J.M.** (2017) Distinct neural encoding schemes emerge for actions generated by the same effector. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
2. Athalye V., Santos F., **Carmena J.M.**, and Costa R.M. (2017) Specific activity patterns are reinforced via closed-loop pairing with phasic VTA activation. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
3. Athalye V., Ganguly K., Costa R.M. and **Carmena J.M.** (2016) Emergence of coordinated neural dynamics supports neuroprosthetic skill learning. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
4. Khanna P., Athalye V., Gowda S., Costa R.M. and **Carmena J.M.** (2016) Modeling the distinct sources of variability during learning of a neuroprosthetic task. Proceedings of EMBC'16, 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando (FL).
5. Khanna P., Stanslaski S., Xiao Y., Ahrens T., Bourget D., Swann N., Starr P., **Carmena J.M.** and Denison T. (2015) Enabling closed-loop neurostimulation research with downloadable firmware upgrades. Proceedings of the IEEE BioCAS 2015 Biomedical Circuits and Systems Conference, Atlanta (GA).
6. Seo D.J., Tang H-Y., **Carmena J.M.**, Rabaey J.M., Alon E., Boser B. and Maharbiz M.M. (2015) Ultrasonic beamforming system for interrogating multiple implantable motes. Proceedings of EMBC'15, 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Milan (Italy).
7. Shanechi M.M., Orsborn A., Moorman H., Gowda S., **Carmena J.M.** (2014) High-performance brain-machine interface enabled by an adaptive optimal feedback-controlled point process decoder. Proceedings of EMBC'14, 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago (IL). 6493-6. doi: 10.1109/EMBC.2014.6945115.

8. Bertrand A., Seo D., Maksimovic F., **Carmena J.M.**, Maharbiz M.M., Alon E., Rabaey JM. (2014) Beamforming approaches for untethered, ultrasonic neural dust motes for cortical recording: a simulation study. Proceedings of EMBC'14, 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago (IL). 2625-8. doi: 10.1109/EMBC.2014.6944161.
9. Chang Y-H., Chen M., Shanechi M., **Carmena J.M.** and Tomlin C.J. (2014) A Design of Neural Decoder by Reducing Discrepancy between Manual Control (MC) and Brain Control (BC). 13th European Control Conference (ECC), Strasbourg, France.
10. Lu J.\*, Chen M.\*, Chang Y.-H.\*, Tomizuka M., **Carmena J.M.** and Tomlin C.J. (2014) Design of a neural decoder by sensory prediction and error correction, in Proceedings of the 53rd IEEE Conference on Decision and Control (CDC), pp. 6999-7004, Los Angeles (CA).
11. Moradi E., Amendola S., Björninen T., Sydänheimo L., Ukkonen L., **Carmena J.M.** and Rabaey J.M. (2014) Wireless testing of ink-jet printed mm-size gold implant antennas for brain-machine interfaces. IEEE International Symposium on Antennas and Propagation, Memphis (TN).
12. Yeager D., Biederman W., Narevsky N., Leverett J., Neely R., **Carmena J.M.**, Alon E. and Rabaey J.M. (2014) A 4.78mm<sup>2</sup> fully-integrated neuromodulation SoC combining 64 acquisition channels with digital compression and simultaneous dual stimulation. VLSI Circuits Symposium, Honolulu (HI).
13. Muller R., Le H.-P., Li W., Ledochowitsch P., Gambini S., Björninen T., Koralek A., **Carmena J.M.**, Maharbiz M.M., Alon E. and Rabaey J.M. (2014) A miniaturized 64-channel, 225 $\mu$ W wireless electrocorticographic neural sensor. IEEE international Solid-State Circuits Conference (ISSCC), San Francisco (CA).
14. Chang Y.H., Chen M., Overduin S.S., Gowda S., **Carmena J.M.** and Tomlin C.J. (2013) Low-rank representation of neural activity and detection of submovements. Proceedings of the 52nd IEEE Conference on Decision and Control, Florence (Italy).
15. Shanechi M. and **Carmena J.M.** (2013) Optimal feedback-controlled point process decoder for adaptation and assisted training in brain-machine interfaces. Proceedings of the 6th International IEEE EMBS Conference on Neural engineering. San Diego (CA).
16. Khanna P., Kelvin S. and **Carmena J.M.** (2013) Volitional phase control of neural oscillations using a brain-machine interface. Proceedings of the 6th International IEEE EMBS Conference on Neural engineering. San Diego (CA).
17. Orsborn A.L., Kelvin S., Dangi S. and Carmena J.M. (2013) Comparison of neural activity during closed-loop control of spike or LFP-based brain-machine interfaces. Proceedings of the 6th International IEEE EMBS Conference on Neural engineering. San Diego (CA).
18. Orsborn A.L. and **Carmena J.M.** (2013) Neural and decoder adaptation in BMI reduces interference from native motor networks. Proceedings of the Translational and Computational Motor Control (TCMC) conference, San Diego (CA)
19. Shanechi M., Orsborn A.L., Gowda S. and **Carmena J.M.** (2013) Proficient BMI control enabled by closed-loop adaptation of an optimal feedback-controlled point process decoder. Proceedings of the Translational and Computational Motor Control (TCMC) conference, San Diego (CA)

20. Björninen T., Moradi E., Sydänheimo L., **Carmena J.M.**, Rabaey J.M. and Ukkonen L. (2013) Electromagnetic modeling and measurement of antennas for wireless brain-machine interface systems. Proceedings of the International Microwave Workshop Series on RF and Wireless Technologies for Biomedical and Healthcare Applications (IMWS-Bio 2013), Singapore.
21. Ledochowitsch P., Koralek A.C., Moses D., **Carmena J.M.**, and Maharbiz M.M. (2013) Sub-mm functional decoupling of electrocortical signals through closed-loop BMI learning. Proceedings of EMBC'13, 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka (Japan).
22. Dangi S., Gowda S. and **Carmena J.M.** (2013) Likelihood Gradient Ascent (LGA): A closed-loop decoder adaptation algorithm for brain-machine interfaces. Proceedings of EMBC'13, 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka (Japan).
23. Dangi S., So K., Orsborn A.L., Gastpar M.C. and **Carmena J.M.** (2013) Brain-machine interface control using broadband spectral power from local field potentials. Proceedings of EMBC'13, 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka (Japan).
24. Chu P., Muller R., Koralek A., **Carmena J.M.**, Rabaey J.M. and Gambini S. (2013) Equalization for intracortical microstimulation artifact reduction. Proceedings of EMBC'13, 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka (Japan).
25. Gowda S., Orsborn A.L. and **Carmena, J.M.** (2012) Parameter estimation for maximizing controllability of linear brain-machine interfaces. Proceedings of EMBC'12, 34<sup>th</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, San Diego (CA).
26. Koralek A.C. and **Carmena J.M.** (2012) BMI learning results in highly precise cell-specific coherence in corticostriatal networks. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
27. So K., Gastpar M. and **Carmena J.M.** (2012) An objective approach to learning movement-related features from local field potentials. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
28. So K., Gastpar M. and **Carmena J.M.** (2011) Assessing directed information as a method for inferring functional connectivity in neural ensembles. Proceedings of EMBC'11, 33<sup>rd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Boston (MA).
29. Orsborn\* A.L., Dangi\* S., Moorman H.G. and **Carmena J.M.** (2011) Exploring time-scales of closed-loop decoder adaptation in brain-machine interfaces. Proceedings of EMBC'11, 33<sup>rd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Boston (MA).
30. So K., Ganguly K., Gastpar M. and **Carmena J.M.** (2011) Redundant information encoding in primary motor cortex during motor task. 5<sup>th</sup> International IEEE EMBS Conference on Neural engineering. Cancun (Mexico).
31. Dangi S., Gowda S., Heliot R. and **Carmena J.M.** (2011) Adaptive Kalman filtering for closed-loop brain-machine interface systems. 5<sup>th</sup> International IEEE EMBS Conference on Neural Engineering. Cancun (Mexico).

32. Cadieu C., Canolty R., Ganguly K., Barbaro N., Knight R.K. and **Carmena J.M.** and Koepsell K. (2011) A phase-amplitude coupled latent variable model applied to dynamical brain states. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
33. So K., Ganguly K., Gastpar M. and **Carmena J.M.** (2011) Functional connectivity in the primary motor cortex during motor tasks. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
34. Zacksenhouse M., Lebedev M., **Carmena J.M.** and Nicolelis M.A.L. (2011) Spike-count analysis reveals the relevant timescales in experiments with brain-machine interfaces. Computational and Systems Neuroscience (COSYNE), Salt Lake City (UT).
35. Koralek A.C., Long J.D., Costa R.M. and **Carmena J.M.** (2010) Corticostriatal dynamics during learning and performance of a neuroprosthetic task. Proceedings of EMBC'10, 32<sup>nd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires (Argentina).
36. Heliot R., Venkatraman S. and **Carmena J.M.** (2010) Decoder remapping to counteract neuron loss in brain-machine interfaces. Proceedings of EMBC'10, 32<sup>nd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires (Argentina).
37. Mark M., Bjorninen T., Chen Y.D., Venkatraman S., Ukkonen L., Sydanheimo L., **Carmena J.M.** and Rabaey J.M. (2010) Wireless channel characterization for mm-size neural implants. Proceedings of EMBC'10, 32<sup>nd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires (Argentina).
38. Canolty R.T., Ganguly K., Kennerley S.W., Cadieu C.F., Koepsell K., Wallis J.D. and **Carmena J.M.** (2010) Single-neuron spike timing depends on global brain dynamics. Computational and Systems Neuroscience 2010. doi: 10.3389/conf.fnins.2010.03.00264
39. Heliot R. and **Carmena J.M.** (2009) A model of motor learning in brain-machine interfaces: predicting neural tuning changes. IEEE Systems, Man and Cybernetics Conference, San Antonio, TX.
40. Jimenez J., Heliot R. and **Carmena J.M.** (2009) Learning to use a brain-machine interface: model, simulation and analysis. Proceedings of EMBC'09, 31<sup>st</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Minneapolis, MN.
41. Venkatraman S., Patten C. and **Carmena J.M.** (2009) Exploiting the 1/f structure of neural signals for the design of integrated neural amplifiers. Proceedings of EMBC'09, 31<sup>st</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Minneapolis, MN. [*Finalist, Student Paper Competition*]
42. Heliot R., Ganguly K. and **Carmena J.M.** (2009) Modeling and experimental validation of the learning process during closed-loop BMI operation. International Conference on Machine Learning and Cybernetics, Baoding (China). [*Lotfi Zadeh Best Conference Paper Award*]
43. Venkatraman S., Hendricks J., Richardson-Burns S., Jan E., Martin D.C. and **Carmena J.M.** (2009) PEDOT coated microelectrode arrays for chronic neural recording and stimulation. 4<sup>th</sup> International IEEE EMBS Conference on Neural engineering. Antalya (Turkey).
44. Ranade G.V., Ganguly K. and **Carmena J.M.** (2009) LFP beta power predicts cursor stationarity in BMI task. 4<sup>th</sup> International IEEE EMBS Conference on Neural Engineering. Antalya (Turkey).

45. Heliot R., Orsborn A. and **Carmena J.M.** (2008) Stiffness control of 2-DOF exoskeleton for brain-machine interfaces. 2<sup>nd</sup> IEEE RAS / EMBS International Conference on Biomedical Robotics and Biomechanics, Scottsdale (AZ).
46. Ganguly K., Torres E.B., Jose J.V. and **Carmena J.M.** (2008) From multiple neural cortical networks to motor mechanical behavior: the importance of inherent learning over separable space-time length scales. 7<sup>th</sup> Annual Computational Neuroscience Meeting, Portland, OR. BMC Neuroscience **9** (Suppl 1):P70.
47. Venkatraman S., Long J.D., Pister K.S.J. and **Carmena J.M.** (2007) Wireless inertial sensors for monitoring animal behavior. Proceedings of EMBC'07, 29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Lyon (France).
48. Kim S.P., **Carmena J.M.**, Nicolelis M.A.L. and Principe J.C. (2005) Multiresolution representations and data mining of neural spikes for brain-machine interfaces. Proc. of the 2<sup>nd</sup> International Conference on Neural Engineering, Arlington, VA (USA).
49. Rao Y.N., Kim S.P., Sanchez J.C., Erdogomus D., Principe J.C., **Carmena J.M.**, Lebedev M.A. and Nicolelis M.A.L. (2005) Learning mappings in BMIs with echo state networks. Proc. of the IEEE-ICASSP, Philadelphia, PA (USA).
50. Sanchez J.C., Principe J.C., **Carmena J.M.**, Lebedev M.A. and Nicolelis M.A.L. (2004) Simultaneous predictions of four kinematic variables for a BMI using a single recurrent neural network. 26<sup>th</sup> Int. Conf. of the IEEE-EMBS, San Francisco, CA (USA).
51. **Carmena J.M.** and Hallam J.C.T. (2002) Narrowband 3D tracking using a biomimetic sonarhead. Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Lausanne (Switzerland).
52. **Carmena J.M.** and Hallam J.C.T. (2001) A comparison of methods for estimating Doppler shift using cochlear filterbank models. European workshop on advanced mobile robots (EUROBOT), pp. 9-16, Lund (Sweden). [[Best Conference Paper Award](#)]
53. **Carmena J.M.** and Hallam J.C.T. (2001) Exploiting the physics: Doppler-based navigation with a bat-inspired mobile robot. Proceedings of the 9th Symposium on Intelligent Robotic Systems, pp. 467-476, Toulouse (France).
54. **Carmena J.M.** and Hallam J.C.T. (2001) A Doppler-based motion controller for an echolocating mobile robot, Towards Intelligent Mobile Robots. Technical Report Series, Dept. of Computer Science, Manchester University, Manchester (UK). ISSN 1361 6161.
55. Peremans H., Müller R., **Carmena J.M.** and Hallam J.C.T. (2000) A biomimetic platform to study perception in bats. Proceedings of SPIE: Sensor Fusion and Decentralized Control in Robotics Systems III, Vol 4196, pp. 168-179, Boston, MA (USA).
56. **Carmena J.M.**, Kim D., and Hallam J.C.T. (2000) Designing artificial ears for animat echolocation. From Animals to Animats 6. pp.73-80, J-A. Meyer et al. (Eds.), MIT Press.
57. **Carmena J.M.** and Hallam J.C.T. (2000) Estimating Doppler shift with a coarse cochlear filterbank. Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vol 1, pp. 221-226, Takamatsu (Japan).
58. Kim D., **Carmena J.M.** and Hallam J.C.T. (2000) Towards an artificial pinna for a narrow band biomimetic sonarhead. Lecture Notes in Computer Science 1801, pp. 113-122, Miller et al. (Eds.), Springer-Verlag.

59. **Carmena J.M.** and Hallam J.C.T. (1999) Improving performance in a multi-robot task through minimal communication. Proceedings of the 7th Symposium on Intelligent Robotic Systems, pp. 329-337, Coimbra (Portugal).

### **Edited Proceedings**

1. Proceedings of the IWINAC Workshop on Robotics and Neurobiology. A. del Pobil, **J.M. Carmena** and Y. Demiris editors. Las Palmas de G. Canaria (Spain) 2005.
2. Proceedings of the SAB'02-Workshop on Motor Control in Humans and Robots: on the interplay of real brains and artificial devices. **J.M. Carmena** and G. Maistros editors. University of Edinburgh, 2002.
3. Proceedings of the Workshop on Biomimetic Ultrasound. **J.M. Carmena**, R. Müller, H. Peremans and J.C.T. Hallam editors. University of Edinburgh, 2000.

### **Dissertations**

- **Carmena J.M.** (2001) Towards a bionic bat: A biomimetic investigation of active sensing, Doppler-shift estimation, and ear morphology design for mobile robots. **Ph.D. thesis**, University of Edinburgh (Scotland, UK).
- **Carmena J.M.** (1998) Cooperative tasks need versatile inter-robot communication systems? **M.S. thesis**, Dept. of Artificial Intelligence, U. of Edinburgh (Scotland, UK).
- **Carmena J.M.** (1997) Design and implementation of a microcontroller-based communication protocol: Applications to mobile robots. **M.S. thesis**, Department of Electronics Engineering, School of Physics, University of Valencia (Spain).

### **Featured Articles in the Press**

- ❖ **Referenced Article:** Seo D.J.\*, Neely R.M.\*, Shen K., Singhal U., Alon E., Rabaey J.M., **Carmena J.M.\*** and Maharbiz M.M.\* (2016) Wireless recording in the peripheral nervous system with ultrasonic neural dust. *Neuron* 91, pp. 529-539. **Featured in:** Scientific American, IEEE Spectrum, Popular Science, Daily Mail, Independent.
- ❖ **Referenced Article:** Canolty R.T., Ganguly K., Kennerley S.W., Cadieu C.F., Koepsell K., Wallis J.D. and **Carmena J.M.** (2010) Oscillatory phase coupling coordinates anatomically-dispersed functional cell assemblies. *Proceedings of the National Academy of Sciences* doi: 10.1073/pnas. 1008306107. **Featured in:** Word Press, ScienceDaily, El Mundo.
- ❖ **Referenced Article:** Ganguly K. and **Carmena J.M.** (2009) Emergence of a stable cortical map for neuroprosthetic control. *PLoS Biology* 7(7), e1000153. doi:10.1371/journal.pbio.1000153. **Featured in:** New York Times, IEEE Spectrum, Technology Review, Communications of the ACM, The Scientist, New Scientist, El Mundo, El Pais.
- ❖ **Referenced Article:** **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 Nicolelis M.A.L. (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. **Featured in:** Time, The Economist, New York Times, Washington Post, Popular Science, New Scientist, The Times (UK), Independent (UK), The Guardian (UK), Associated Press.

- ❖ **Referenced Article: Carmena J.M.,** Kim D. and Hallam J.C.T. (2000) Designing artificial ears for animat echolocation. From Animals to Animats 6. *Proceedings 6th Int. Conf. on Simulation of Adaptive Behavior*, pp. 73-80, J-A. Meyer *et al.* (Eds.), MIT Press. **Featured in:** New Scientist, The Times (UK), Edinburgh Evening News (UK), Focus (EU).



## Invited Talks

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1. **Keynote speaker**, IEEE International Conference on Systems, Man, and Cybernetics (SMC), Budapest (Hungary), October 2016.
2. Invited speaker, 5th Champalimaud Neuroscience Symposium, Champalimaud Center for the Unknown, Lisbon (Portugal), September 2016.
3. **Keynote speaker**, Forum on "New technologies to treat neurodisorders: neuroprosthetics", IBSA Foundation, Geneva (Switzerland), June 2016.
4. Invited speaker, Minisymposium on advances in neurotechnologies, 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'16) Orlando (FL), August 2016.
5. Invited speaker, IEEE BRAIN Initiative panel, 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'16) Orlando (FL), August 2016.
6. Invited speaker, Office of Naval Research (ONR) Computational Neuroscience Workshop, Amherst (MA), June 2016.
7. Invited speaker, Conference on Motor Control Circuits: Structure, Function and Behavior, Janelia Research Campus, Ashburn (VA), May 2016.
8. Invited speaker, Symposium on Biological Information Processing, Max Planck Institute for Biological Cybernetics, Tuebingen (Germany), April 2016.
9. Invited speaker, Annual Meeting of the Neural Control of Movement Society, Montego Bay (Jamaica), April 2016.
10. Invited speaker, Workshop at Computational and Systems Neuroscience (Cosyne), Snowbird (UT), February 2016.
11. Invited speaker, Neuroscience Seminar Series, University of California San Diego, San Diego (CA), December 2015.
12. Guest lecture (host: Dr. Jack Gallant), University of California Berkeley, Berkeley (CA), November 2015.
13. **Keynote speaker**, Workshop on Translational and Computational Motor Control (TCMC), Chicago (IL), October 2015.
14. Invited speaker, Center for Neural Science Seminar Series, New York University, New York (NY), October 2015.
15. **Plenary Talk**, SSNR'15, Summer School on Neurorehabilitation, Valencia (Spain), September 2015.
16. Invited speaker, Medtronic Inc., Minneapolis (MN), July 2015.
17. Invited speaker, CRCNS Berkeley Summer Course in Mining and Modeling of Neuroscience Data, University of California, Berkeley (CA), July 2015.
18. Invited speaker, Institute of Neuroscience (ION), Shanghai (China), July 2015.
19. Invited speaker, Cold Spring Harbor Asia (CSHA) Francis Crick Symposium: Advances in Neuroscience, Suzhou (China), July 2015.
20. **Keynote speaker**, 11<sup>th</sup> Computational Motor Control Workshop (CMCW), Ben Gurion University, Be'er Sheva (Israel), June 2015.
21. Invited speaker, ABC Robotics Workshop, Ben Gurion University, Be'er Sheva (Israel), June 2015.
22. Invited speaker, Kavli Workshop on Neuroscience Inspired Computing, Berkeley (CA), May 2015.
23. Invited speaker, Symposium on Brain-Machine Interfaces, IEEE Neural Engineering Conference, Montpellier (France), April 2015.
24. Invited speaker, Department of Electrical and Computer Engineering seminar series, Carnegie Mellon University, Pittsburgh (PA), April 2015.
25. Invited speaker, Workshop on Reprogramming the Human Brain, University of California, Berkeley (CA), March 2015.
26. **Plenary talk**, Workshop in Clinical Brain-Machine Interfaces (CBMI), Tokyo (Japan), March 2015.
27. Invited speaker, Center for Theoretical Neuroscience Seminar, Columbia University, New York (NY), December 2014.
28. Invited speaker (host Dr. Reza Shadmehr), Department of Biomedical Engineering, Johns

- Hopkins University, Baltimore (MD), June 2014.
29. Invited speaker, Workshop on Neural Population Dynamics Underlying Sensorimotor Integration, HHMI Janelia Farm Research Campus, Ashburn (VA), June 2014.
  30. Invited speaker, Center for Mind, Brain and Computation seminar series, Stanford University, Palo Alto (CA), May 2014.
  31. Invited speaker, Center for Research and Advanced Studies of the National Polytechnic Institute (CINVESTAV) Mexico City, Mexico, March 2014.
  32. Invited speaker, SEMBA – Symposium on Engineering, Medicine and Biology Applications. Taipei, Taiwan, January 2014.
  33. Dept. of EECS Industrial Advisory Board Meeting, University of California, Berkeley (CA), November 2013
  34. **Keynote speaker**, 3<sup>rd</sup> Annual Symposium for the Center for NeuroEngineering, Gulf Coast Consortia (GCC), Houston (TX), October 2013.
  35. Invited speaker, Life Science Symposium, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne (Switzerland), August 2013.
  36. Invited speaker, 3<sup>rd</sup> International Symposium on the Brain Injury in Children, University of Toronto (Canada), July 2013.
  37. Invited speaker, Global Future 2045 Congress, Lincoln Center, New York City (NY), June 2013.
  38. Invited speaker, Department of Biomedical Engineering seminar series, Johns Hopkins University, Baltimore (MD), June 2013.
  39. **Keynote speaker**, Annual Conference of the International Functional Electrical Stimulation Society (IFESS), San Sebastian (Spain), June 2013.
  40. Invited speaker, Symposium on Dynamics of Microcircuits, University of California, Los Angeles (CA), May 2013.
  41. Invited speaker, NEO group, Qualcomm Inc., San Diego (CA), May 2013.
  42. Invited speaker, 2<sup>nd</sup> Janelia Conference on "The Neural Basis of Vibrissa-Based Tactile Sensation", HHMI Janelia Farm Research Campus, Ashburn (VA), April 2013.
  43. Invited speaker, Center for Sensorimotor Neural Engineering Seminar Series, University of Washington, Seattle (WA) April 2013.
  44. Invited speaker, CITRIS Research Exchange Seminar, University of California, Berkeley (CA), April 2013.
  45. Invited speaker, Máster Universitario de Investigación en Tecnologías industriales y de Telecomunicación, Universidad Miguel Hernandez, Elche, (Spain), March, 2013.
  46. Invited speaker, Workshop Neurorehabilitation Robotics, Arizona State University, Tempe (AZ), February 2013.
  47. 9th Kavli Futures Symposium: The Intersection of Nanoscience and Neuroscience at UC Berkeley. Berkeley, (CA), January 2013.
  48. Joint INC-IEM Neuroengineering Seminar Series. University of California, San Diego, (CA), November 2012.
  49. Invited speaker. 2<sup>nd</sup> International Symposium on Neurorehabilitation: from basics to future, Valencia (Spain), October 2012.
  50. **Keynote speaker**, UC Davis Neuroscience Retreat, Lake Tahoe (CA), September 2012.
  51. Invited Speaker, Department of Biomedical Engineering, University of Miami, Miami (FL), September 2012.
  52. Invited Speaker, Department of Biomedical Engineering Seminar Series, Case Western Reserve University, Cleveland (OH), September 2012.
  53. Invited Speaker, EMBC'2012 Workshop on Brain Dynamics in Human Motor Control, San Diego (CA), August 2012.
  54. Invited speaker, Simposium de Neurociencias de la Sociedad Española de Fisica. Fundacion Ramon Areces, Madrid (Spain), July 2012.
  55. **Plenary talk**, BioRob'2012 IEEE International Conference on Biomedical Robotics and Biomechatronics Roma (Italy), June 2012.
  56. Invited speaker, European School of Neuroengineering, Genova (Italy), June 2012.
  57. Invited speaker, Hospital Nacional de Paraplegicos. Toledo (Spain), May 2012.
  58. Invited speaker, Neurociencia y Sociedad. Residencia de Estudiantes, CSIC, Madrid (Spain),

- May 2012.
59. Invited speaker, One Mind for Research Forum, University of California, Los Angeles, (CA), May 2012.
  60. Seminar series, Instituto Cajal-CSIC, Madrid (Spain), March 2012.
  61. Invited speaker, Tecnalia, San Sebastian (Spain), February 2012.
  62. Opening Lecture, 8<sup>th</sup> Christmas Meeting, Instituto de Neurociencias, Alicante (Spain), December 2011.
  63. Invited speaker, BME Seminar Series, Department of Biomedical Engineering, Johns Hopkins University, Baltimore (MD), November 2011.
  64. Invited Speaker, IEEE-SMC 3rd annual Workshop on Brain-Machine Interfaces, Anchorage (AK), October 2011.
  65. Grand Rounds, Department of Neurosurgery, University of California, San Francisco (CA), August 2011.
  66. CRCNS Berkeley Summer Course in Mining and Modeling of Neuroscience Data, University of California, Berkeley (CA), July 2011.
  67. International Joint Conference on Neural Networks (IJCNN) Symposium, From Brains to Machines, San Jose (CA), July 2011.
  68. 8th Annual World Congress of IBMISPS on Brain, Spinal Cord Mapping & Image Guided Therapy, San Francisco (CA), June 2011.
  69. Neurocolloquium, Max Planck Institute/University of Tuebingen, Tuebingen (Germany), May 2011.
  70. College Student Interest Group in Neurology (Co-SIGN), Mind Over Matter Conference, Stanford University, Palo Alto (CA), May 2011.
  71. Department of Electrical Engineering Seminar Series, University of California, Los Angeles, (CA), May 2011.
  72. Neuroscience Programme Seminar Series. Champalimaud, Centre for the Unknown. Lisbon (Portugal), March 2011.
  73. Departamento de Neurociencias, Universidad Autonoma de Madrid, Madrid (Spain), March 2011.
  74. Cosyne Workshop on Emerging Systems Theories in BMI Neuroscience. Snowbird, Salt Lake City (UT), February 2011.
  75. Social Science Colloquium series, "Emerging Minds: Seeking Meaning in a Physical World." Bucknel University, Lewisburg (PA), February 2011.
  76. School of Biological and Health Systems seminar, Arizona State University, Tempe (AZ), February 2011.
  77. Bioengineering Department seminar, University of Pittsburgh, Pittsburgh (PA), February 2011.
  78. Grupo de Bioingenieria, Consejo Superior de Investigaciones Cientificas (CSIC), Madrid (Spain), November 2010.
  79. Automatic Control Laboratory, Swiss Federal Institute of Technology (ETH), Zurich (Switzerland), November 2010.
  80. CNS Workshop on 'Computational models for movement control and adaptation during BMI operation', San Antonio (TX), July 2010.
  81. US-Turkey Advanced Study Institute on Global Healthcare Challenges, Antalya (Turkey), July 2010.
  82. AREADNE - Research in Encoding and Decoding of Neural Ensembles. Santorini (Greece), June 2010.
  83. CMOS Emerging Technologies Workshop, Whistler, British Columbia (Canada), May 2010.
  84. Panel Session on Decoding from Neural Ensembles. Annual Meeting of the Society for the Neural Control of Movement, Naples (FL), April 2010.
  85. Beyond Neural Cartography Workshop, University of Southern California, Los Angeles (CA), March 2010.
  86. Invited Speaker, Facultad de Informatica, Universidad de Murcia (Spain), March 2010.
  87. Guest lecture (host: Dr. Krishna Shenoy), Stanford University, Palo Alto (CA), March 2010.
  88. Werkgemeenschap voor Informatie- en Communicatietheorie (WIC) Winter Meeting, Technische Universiteit Eindhoven (The Netherlands), February 2010.
  89. **Keynote speaker**. Tools for Brain-Computer Interaction (TOBI) Workshop, Graz (Austria),

- February 2010.
90. Invited speaker. International Symposium on Neurorehabilitation, Valencia (Spain), October 2009.
  91. Tutorial on brain-machine interfaces, IEEE Systems, Man and Cybernetics conference, San Antonio (TX), October 2009.
  92. Neuroscience seminar (hosted by Dr. Bence Ölveczky), Department of Organismic and Evolutionary Biology, Harvard University, September 2009.
  93. UCB/UCSF Graduate Program in Bioengineering retreat, Lake Tahoe (CA), September 2009.
  94. National Science Foundation, Neuromechanics workshop, September 2009.
  95. Army Research Office Workshop "Beyond Brain-Machine Interface", IEEE Engineering in Medicine and Biology Conference, Minneapolis (MN), September 2009.
  96. **Keynote speaker.** International Conference on Machine Learning and Cybernetics, Baoding (China), July 2009.
  97. Invited speaker, Institute of Bioengineering seminar series, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne (Switzerland), June 2009.
  98. Instituto de Neurociencias, CSIC-Universidad Miguel Hernandez, San Juan, Spain, June 2009.
  99. Distinguished lecture. Royal Academy of Medicine and Surgery, Murcia, Spain, June 2009.
  100. **Keynote speaker.** Simposio CEA de Bioingeniería: Técnicas de BCI. Universidad Miguel Hernandez, Elche, Spain, June 2009.
  101. Satellite Workshop. Annual Meeting of the Society for the Neural Control of Movement. Waikoloa (HI), April 2009.
  102. McGovern Institute Seminar (hosted by Dr. Emilio Bizzi), Massachusetts Institute of Technology, Cambridge (MA), January 2009.
  103. Nanotechnology as an Enabler for Neuroscience, Neuroengineering and Neural Prostheses Workshop. Stanford University, Palo Alto (CA), December 2008.
  104. Bio-E\* Series. University of California, Berkeley (CA), October 2008.
  105. Workshop on Environmental and BioMedical Monitoring Microsystems, BSAC, University of California, Berkeley (CA), September 2008.
  106. Neuro-inspired and Neuro-applied Computing Workshop, Gigascale Systems Research Center, Berkeley (CA), August 2008.
  107. NIH, National Institute on Alcohol Abuse and Alcoholism, Section on In Vivo Neural Function, Bethesda (MD), June 2008.
  108. NIH, National Institute of Neurological Disorders and Stroke, Human Cortical Physiology Section, Bethesda (MD), June 2008.
  109. IEEE-ICRA Workshop in wearable robots, Pasadena (CA), June 2008.
  110. Catedra de Informatica y Salud. Universidad Politecnica de Valencia (Spain), June 2008.
  111. Real-time brain interfacing applications workshop, Columbus (OH), May 2008.
  112. 2nd Annual Berkeley Conference on Translational Research, University of California, Berkeley (CA), April 2008.
  113. Computer Science and Engineering Department, University of Washington, Seattle (WA), February 2008.
  114. Berkeley Wireless Research Center (BWRC) winter retreat, Monterey, CA, January 2008.
  115. **Keynote speaker.** Brain Computer Interface Workshop, The MAIA project. Leuven (Belgium), November 2007.
  116. Cognitive Computing Workshop, University of California, Berkeley (CA), May 2007.
  117. Berkeley Initiative in Soft Computing (BISC) group, University of California, Berkeley (CA), February 2007.
  118. **Keynote speaker.** Brain Computer Interface Workshop, The MAIA project. Rome (Italy), November 2006.
  119. Pierce Community College, Los Angeles (CA), November 2006.
  120. Bay Area Signals, Information and Control Symposium, University of California, Berkeley (CA), June 2006.
  121. Grand Rounds, Department of Neurosurgery, University of California, San Francisco (CA), June 2006.

122. Redwood Center for Theoretical Neuroscience, University of California, Berkeley (CA), October 2005.
123. Guest lecture (hosted by Dr. John Canny). Department of Electrical Engineering and Computer Science, University of California, Berkeley (CA), October 2005.
124. Epstein Laboratory, Department of Otolaryngology, University of California, San Francisco (CA), October 2005.
125. Department of Bioengineering, Stanford University, Palo Alto (CA), May 2005.
126. Alfred E. Mann Foundation for Biomedical Engineering, Valencia (CA), May 2005.
127. Department of Biomedical Engineering, University of Southern California, Los Angeles (CA), May 2005.
128. Department of Electrical Engineering and Computer Science, University of California, Berkeley (CA), April 2005.
129. Department of Biomedical Engineering, University of Minnesota, Minneapolis (MN), April 2005.
130. Cosyne Workshop on Emerging Directions in Cortical Brain-Machine Interfaces for Control. Snowbird, Salt Lake City (UT), March 2005.
131. Sensorimotor Program, Rehabilitation Institute of Chicago, Northwestern University Medical School, Chicago (IL), March 2005.
132. Department of Biomedical Engineering, Northwestern University, Evanston (IL), March 2005.
133. School of Biomedical Engineering, Science and Health Systems, Drexel University, Philadelphia (PA), March 2005.
134. Department of Neurobiology and Anatomy, Drexel University, Philadelphia (PA), March 2005.
135. Inst. of Cognitive and Brain Sciences, University of California, Berkeley (CA), March 2005.
136. Department of Biomedical Eng., Rutgers University, Piscataway (NJ), Feb. 2005.
137. Guest lecture (hosted by Dr. Craig Henriquez), Department of Biomedical Engineering, Duke University, Durham (NC), USA, November 2004.
138. Department of Biomedical Engineering. Yale University, New Haven, (CT), November 2004.
139. IEEE Eastern NC Section, Robotics and Automation Chapter. Research Triangle Park, (NC), November 2004.
140. **Keynote speaker.** IASTED International Conference on Artificial Intelligence and Soft Computing, Marbella (Spain), September 2004.
141. Department of Electronic and Electrical Engineering, Imperial College of Science, Technology and Medicine, London (UK), September 2004.
142. Talent Identification Program (TIP), Dept. of Biomedical Engineering, Duke University, Durham (NC), USA, June 2004.
143. Spinal Cord Symposium of the Christopher Reeve Paralysis Foundation, Oak Brook Hills, IL (USA), March 2004.
144. 1<sup>st</sup> Meeting on Advances in Neuroscience. Neurosciences Institute, University Miguel Hernandez, San Juan de Alicante (Spain), December 2003.
145. Guest lecture (host Dr. Craig Henriquez), Department of Biomedical Engineering, Duke University, Durham (NC), USA, November 2003.
146. Behavioral, Ecological and Sociobiological Topics talk, Department of Biological Anthropology and Anatomy, Duke University, Durham (NC), November 2003.
147. Talent Identification Program (TIP), Dept. of Biomedical Engineering, Duke University, Durham (NC), USA, July 2003.
148. Institute of Perception, Action and Behavior weekly seminar. Division of Informatics. University of Edinburgh, Scotland (UK), June 2000.
149. Signal Processing Group seminar, Department of Electronics, University of Valencia (Spain), December 1999.

**Peer-review**

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Ad-hoc reviewer for: Nature, Nature Neuroscience, Neuron, PNAS, Trends in Neurosciences, Journal of Neuroscience, Journal of Neurophysiology, Journal of Neuroscience Methods, European Journal of Neuroscience, Brain Research Bulletin, IEEE Transactions on Biomedical Engineering, IEEE Transactions on Neural Systems and Rehabilitation Engineering, IEEE Transactions on Neural Networks, Neurocomputing, Frontiers in Neuroprosthetics, Frontiers in Integrative Neuroscience. IEEE Trans. on Systems, Man, and Cybernetics, parts A & B.