

*Curriculum Vitae*

**STEVEN M. CHASE**

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**EDUCATION**

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<b>Ph.D.</b>	Biomedical Engineering	Johns Hopkins University	2006
<b>M.S.</b>	Electrical Engineering	University of California, Berkeley	1999
<b>B.S. (<i>with honors</i>)</b>	Applied Physics	California Institute of Technology	1997

**ACADEMIC POSITIONS**

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<b>Associate Professor</b>	<b>Carnegie Mellon University</b>	2017-current
CIT Dean's Early Career Fellow		
Assistant Professor		2011-2017
Center for the Neural Basis of Cognition and Department of Biomedical Engineering		
Courtesy Appointments: Robotics Institute, Electrical & Computer Engineering		
<b>Visiting Research Scholar</b>	<b>University of Pittsburgh</b>	2010-2011
Department of Neurobiology		
<b>Post-doctoral Research Associate</b>	<b>Carnegie Mellon University</b>	2006-2010
Department of Statistics		
Jointly mentored by:		
Dr. Robert E. Kass, Dept. of Statistics, Carnegie Mellon University, and		
Dr. Andrew B. Schwartz, Dept. of Neurobiology, University of Pittsburgh		

**HONORS AND PROFESSIONAL ACHIEVEMENTS**

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CIT Dean's Early Career Fellowship	2017
NSF CAREER Award	2016
Curci Foundation Research Awards	2015-2017
Wimmer Faculty Fellowship	2013
Individual National Research Service Award, NIH grant DC05742	2002
California Fellowship in Microelectronics	1997
Caltech Merit Scholarship	1996
Caltech Summer Undergraduate Research Fellowships (3)	1994-1996

## FUNDING

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### Current

NIH (2R01-HD071686) <i>Shaping neural population dynamics to facilitate learning</i> Duration: 4/21/2017-4/20/2022	Co-PI	Total Amount: \$2,181,120
NSF (IOS1553252) - <b>CAREER Award</b> <i>CAREER: Neural mechanisms of skill learning</i> Duration: 9/1/2016-8/31/2021	PI	Total Amount: \$800,000
NSF (BCS1533672) - <b>Brain-Initiative Grant</b> <i>NCS-FO: The structure of neural variability during motor learning</i> Duration: 9/1/2015-8/31/2019	PI	Total Amount: \$868,950
PA Dept of Health Research Formula Grant <i>Predicting short time scale neural reorganization during learning</i> Duration: 1/1/2017-12/31/2019	PI	Total Amount: \$300,000
Curci Foundation <i>Computational and biological approaches to delineate the neural circuitry of learning</i> Duration: 3/1/2017-2/28/2018	Co-PI	Total Amount: \$250,000
NSF (IIS1650994) <i>EAGER: Controlling a robotic third hand - exploring use of distributed intelligence from autonomy to brain machine interfaces for augmenting human capability</i> Duration: 8/15/2016-7/31/2018	Co-I (PI: Wactler)	Total Amount: \$300,000

### Completed

NIH (R01-HD071686) <i>Dissecting brain-computer interfaces: a manifold &amp; feedback-control approach</i> Duration: 9/1/2011-6/1/2017 (NCE)	Co-I (PIs: Yu & Batista)	Total Amount: \$1,575,000
DARPA <i>Neural control of dexterous manipulation and translation to a portable system</i> Duration: 9/1/2016-8/31/2017	Co-I (PI: Collinger)	Total Amount: \$39,343 (Chase-lab portion)
IARPA <i>MICrONS: Visual cortical neural circuits for compositional learning and inference</i> Duration: 1/15/2016-7/15/2017	Co-I (PI: Lee)	Total Amount: \$49,674 (Chase-lab portion)
Curci Foundation <i>Computational and biological approaches to delineate the neural circuitry of learning</i> Duration: 3/1/2016-2/28/2017	Co-PI	Total Amount: \$200,000
Craig H. Neilsen Foundation <i>A self-recalibrating brain-computer interface</i> Duration: 1/1/2014-6/30/2016	Co-PI	Total Amount: \$289,651
Curci Foundation <i>Computational and biological approaches to delineate the neural circuitry of learning</i> Duration: 3/1/2015-2/29/2016	Co-PI	Total Amount: \$200,000

CMU ProSEED Grant <i>Computational and biological approaches to delineate the neural circuitry of learning</i> Duration: 1/1/2015-12/31/2015	PI	Total Amount: \$50,000
DARPA <i>Reliable cortical interfaces</i> Duration: 3/1/2012-12/31/2012	Co-PI	Total Amount: \$273,527 (Chase-lab portion)
PA Dept of Health Research Formula Grant <i>Correlated structure in motor cortical populations</i> Duration: 1/1/2012-12/31/2015	PI	Total Amount: \$733,494

## TEACHING

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### *Classes*

86-631/42-631 <b>Neural Data Analysis</b> (9 units)	FCEs: 28 enrolled, 21 responders, 1 audit Instructor: 4.7/5.0, Course: 4.8/5.0	Fall 2017
86-631/42-631 <b>Neural Data Analysis</b> (9 units)	FCEs: 22 enrolled, 21 responders, 2 audit Instructor: 4.7/5.0, Course: 4.6/5.0	Fall 2016
42-101 <b>Introduction to BME</b> (12 units)	FCEs: 54 enrolled, 37 responders, 0 audit Instructor: 4.1/5.0, Course: 4.0/5.0	Fall 2015
86-631/42-631 <b>Neural Data Analysis</b> (9 units)	FCEs: 17 enrolled, 13 responders, 0 audit Instructor: 4.8/5.0, Course: 4.7/5.0	Fall 2015
42-101 <b>Introduction to BME</b> (12 units)	FCEs: 76 enrolled, 52 responders, 0 audit Instructor: 4.3/5.0, Course: 4.1/5.0	Spring 2015
86-631/42-631 <b>Neural Data Analysis</b> (9 units)	FCEs: 19 enrolled, 17 responders, 1 audit Instructor: 4.8/5.0, Course: 4.8/5.0	Fall 2014
42-101 (co-taught w/Newell Washburn) <b>Introduction to BME</b> (12 units)	FCEs: 55 enrolled, 30 responders, 0 audit Instructor: 3.9/5.0, Course: 3.8/5.0	Fall 2013
86-631/42-631 <b>Neural Data Analysis</b> (9 units)	FCEs: 19 enrolled, 15 responders, 3 audit Instructor: 4.8/5.0, Course: 4.7/5.0	Fall 2013
86-601 <b>Topics in Motor Control</b> (3 units)	FCEs: 3 enrolled, 2 responders, 2 audit Instructor: 5.0/5.0, Course: 4.5/5.0	Spring 2013
42-699B/86-595 <b>Neural Data Analysis</b> (9 units)	FCEs: 14 enrolled, 14 responders, 1 audit Instructor: 4.9/5.0, Course: 4.7/5.0	Fall 2012
86-595/42-595 <b>Neural Data Analysis</b> (12 units)	FCEs: 5 enrolled, 5 responders, 2 audit Instructor: 4.8/5.0, Course: 4.8/5.0	Spring 2012

### *Guest Lectures*

- NEUS 627 / BEHN 640 (Oregon Health and Science University):  
Systems Neuroscience Fall 2017
- 42-447: Rehabilitation Engineering Fall 2017
- 42-101: Introduction to BME Fall 2017
- uPNC Summer Seminar Series Summer 2017
- 42-101: Introduction to BME Spring 2017
- 42-201: Professional Issues in BME Spring 2017

7. 42-201: Professional Issues in BME	Fall 2016
8. 42-101: Introduction to BME	Fall 2016
9. uPNC Summer Seminar Series	Summer 2016
10. 42-630: Introduction to Neuroscience for Engineers	Spring 2016
11. 42-201: Professional Issues in BME	Spring 2016
12. 42-101: Introduction to BME	Spring 2016
13. uPNC Summer Seminar Series	Summer 2015
14. 03-161: Molecules to Mind	Spring 2015
15. 42-201: Professional Issues in BME	Spring 2015
16. 42-101: Introduction to BME	Fall 2014
17. 42-632: Neural Signal Processing	Spring 2014
18. 80-270: Philosophy of Mind	Spring 2014
19. 15-386/15-686: Neural Computation	Spring 2014(2)
20. 15-386/15-686: Neural Computation	Spring 2014(1)
21. 18-819: Neural Technology, Sensing and Stimulation	Fall 2013
22. uPNC Summer Seminar Series	Summer 2013
23. 36-759: Statistical Models of the Brain	Spring 2013
24. 42-201: Professional Issues in BME	Spring 2013
25. uPNC Summer Seminar Series	Summer 2012
26. 42-201: Professional Issues in BME	Spring 2012
27. 15-386/15-686: Neural Computation	Spring 2012
28. 18-101: Introduction to Electrical and Computer Engineering	Fall 2012
29. 42-101: Introduction to BME	Spring 2012
30. BIOEN 2696 (Pitt): Control theory in neuroscience	Spring 2012
31. BIOEN 2800 (Pitt): Neurotechnology	Spring 2012
32. 86-375/86-675: Computational Perception	Spring 2012
33. uPNC Summer Seminar Series	Summer 2011
34. 15-386/15-686: Neural Computation	Spring 2011
35. 15-386/15-686: Neural Computation	Spring 2010
36. MSNBIO 2632 (Pitt): Advanced Neurophysiology	Spring 2007

## INTELLECTUAL PROPERTY

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1. Disclosure (source code): Golub MD, **Chase SM**, and Yu BM (2017). Matlab code for internal model estimation.
2. Disclosure (invention): Sharma A, Nguyen K, **Chase SM**, and Gittis A (2016). A split-wheel treadmill system for rodents. Provisional U.S. Patent Application No. 62/496,572.
3. Patent: **Chase SM**, Chang-Hasnain CJ, and Waite JM (2004). Apparatus and method for controlled cantilever motion through torsional beams and a counterweight. US Patent #6,813,053 B1

## PUBLICATIONS

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### Peer Reviewed Journal Articles

1. Golub MD, Sadtler PT, Oby ER, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \*Chase SM, \*Yu BM (*in press*). Learning by neural reassociation. *Nature Neuro*.  
[Subject of a News & Views review.]
2. Zhang Y and Chase SM (*in press*). Optimizing the usability of brain computer interfaces. *Neural Comp*.
3. Bittner SR, Williamson RC, Snyder AC, Litwin-Kumar A, Doiron B, \*Chase SM, \*Smith MA, and \*Yu BM (2017). Population activity structure of excitatory and inhibitory neurons. *PLoS One* 12(8): e0181773.
4. Suway SB, Orellana J, McMorland AJC, Fraser GW, Liu Z, Velliste M, Chase SM, Kass RE, and Schwartz AB (2017). Temporally segmented directionality in the motor cortex. *Cerebral Cortex* 7:1-14.
5. Rasmussen RG, Schwartz AB, and Chase SM (2017). Dynamic range adaptation in primary motor cortical populations. *eLife* 2017;6:e21409.
6. Oby ER, Perel S, Sadtler PT, Ruff DA, Mischel JL, Montez DF, Cohen MR, \*Batista AP, and \*Chase SM (2016). Extracellular voltage threshold settings can be tuned for optimal encoding of movement and stimulus parameters. *J Neural Eng*. 13:036009.
7. Golub MD, \*Yu BM, and \*Chase SM (2015). Internal models for interpreting neural population activity during sensorimotor control. *eLife* 10.7554/eLife.10015.
8. Zhang Y and Chase SM (2015) Recasting brain-machine interface design from a physical control system perspective. Review. *J Comp Neurosci*. 39:107-118.
9. Perel S, Sadtler PT, Oby ER, Ryu SI, Tyler-Kabara EC, \*Batista AP, and \*Chase SM (2015). Single-unit activity, threshold crossings and local field potentials in motor cortex differentially encode reach kinematics. *J Neurophysiol*. 114: 1500-1512.
10. Kozai T, Du Z, Gugel Z, Smith MA, Chase SM, Bodily LM, Caparosa EM, Friedlander RM, Cui XT (2015) Comprehensive chronic laminar single-unit, multi-unit, and local field potential recording performance with planar single shank electrode arrays. *J Neurosci Meth*. 242C:15-40.
11. Sadtler PT, Quick KM, Golub MD, Chase SM, Ryu SI, Tyler-Kabara EC, \*Yu BM, and \*Batista AP (2014). Neural constraints on learning. *Nature*. 512:423-426.  
[Cover feature and subject of a research highlight.]
12. Todorova S, Sadtler PT, Batista AP, Chase SM, and Ventura V (2014). To sort or not to sort: the impact of spike-sorting on neural decoding performance. *J Neural Eng*. 11:056005.
13. Golub MD, Yu BM, Schwartz AB, and Chase SM (2014). Motor-cortical control of movement speed with implications for brain-machine interface control. *J Neurophysiol*. 112:411-429.
14. Chase SM, Kass RE, and Schwartz AB (2012) Behavioral and neural correlates of visuomotor adaptation observed through a brain-computer interface in primary motor cortex. *J Neurophysiol*. 108:624-644.

\* denotes joint authorship

15. **Chase SM**, Schwartz AB, and Kass RE (2010) Latent inputs improve estimates of neural encoding in motor cortex. *J Neurosci.* 30:13873-13882.
16. Legenstein R, **Chase SM**, Schwartz AB, and Maass W (2010) A reward-modulated Hebbian learning rule can explain experimentally observed network reorganization in a brain control task. *J Neurosci* 30:8400-8410.
17. Koyama S, **Chase SM**, Whitford A, Velliste M, Schwartz AB, and Kass RE (2010) Comparison between decoding algorithms in open-loop and closed-loop performance. *J Comp Neurosci* 29:73-87.
18. Legenstein R, **Chase SM**, Schwartz AB, and Maass W (2009) Functional network reorganization in motor cortex can be explained by reward-modulated Hebbian learning. In: *Advances in Neural Information Processing Systems* 22.
19. **Chase SM**, Schwartz AB, and Kass RE (2009) Bias, optimal linear estimation, and the differences between open-loop simulation and closed-loop performance of brain-computer interface algorithms. *Neural Networks* 22:1203-1213.
20. Fraser GW, **Chase SM**, Whitford A, and Schwartz AB (2009) Control of a brain-computer interface without spike sorting. *J Neural Eng* 6:055004.
21. \*Jarosiewicz B, \***Chase SM**, Fraser GW, Velliste M, Kass RE, and Schwartz AB (2008) Functional network reorganization during learning in a brain-computer interface paradigm. *PNAS* 105:19486-19491.  
[Recommended by Faculty of 1000.]
22. **Chase SM** and Young ED (2008) Cues for sound localization are encoded in different aspects of spike trains in the inferior colliculus. *J Neurophysiol* 99:1672-1682.
23. **Chase SM** and Young ED (2007) First-spike latency information in single neurons increases when referenced to population onset. *PNAS* 104:5175-5180.
24. **Chase SM** and Young ED (2006) Spike-timing codes enhance the representation of multiple simultaneous sound-localization cues in the inferior colliculus. *J Neurosci* 26:3889-3898.  
[Ranked 'must read' by Faculty of 1000.]
25. **Chase SM** and Young ED (2005) Limited segregation of different types of sound localization information among classes of units in the inferior colliculus. *J Neurosci* 25:7575-7585.  
[Recommended by Faculty of 1000.]

### ***Peer Reviewed Conference Papers***

26. Zhang Y and **Chase SM** (2016). A control-theoretic approach to brain-computer interface design. *American Control Conference (ACC)* 2016:5765-5771.
27. Zhang Y and **Chase SM** (2013). A stabilized dual Kalman filter for adaptive tracking of brain-computer interface decoding parameters. *Proc 35<sup>th</sup> Annual Conf IEEE EMBS* 7100-7103.
28. Perel S, Sadtler PT, Godlove JM, Ryu SI, Wang W, Batista AP, and **Chase SM** (2013). Direction and speed tuning of motor-cortex multi-unit activity and local field potentials during reaching movements. *Proc 35<sup>th</sup> Annual Conf IEEE EMBS* 299-392.
29. Golub MD, \***Chase SM**, \*Yu BM (2013). Learning an Internal Dynamics Model from Control Demonstration. *JMLR Workshop & Conference Proceedings* 28:606-614.

30. Golub MD, \*Yu BM, and \*Chase SM (2012) Internal models engaged by brain-computer interface control. Proc 34<sup>th</sup> Annual Conf IEEE EMBS 1327-1330.
31. Zhang Y, Schwartz AB, Chase SM, and Kass RE (2012) Bayesian learning in assisted brain-computer interface tasks. Proc 34<sup>th</sup> Annual Conf IEEE EMBS 2740-2743.  
[Finalist, student paper competition.]

### **Reviews, Book Chapters & Invited Commentaries**

32. Huggins JE, Guger C, Ziat M, Zander TO, Taylor D, Tangermann M, Soria-Frisch A, Simeral J, Scherer R, Rupp R, Ruffini G, Robinson DKR, Ramsey NF, Nijholt A, Müller-Putz G, McFarland DJ, Mattia D, Lance BJ, Kindermans PJ, Iturrate I, Herff C, Gupta D, Do AH, Collinger JL, Chavarriaga R, Chase SM, Bleichner MG, Batista A, Anderson CW, Aarnoutse EJ (2017) Workshops of the sixth international brain-computer interface meeting: brain-computer interfaces past, present, and future. *Brain-Computer Interfaces* 4:3-36.
33. Golub MD, Chase SM, Batista AP, and Yu BM (2016) Brain-computer interfaces for dissecting cognitive processes underlying sensorimotor control. *Curr Opin Neurobio* 37:53-58.
34. \*Yu BM and \*Chase SM (2014) Shedding light on learning. *Nature Neurosci.* 17:746-747. *Commissioned commentary (News and Views) on "Volitional modulation of optically recorded calcium signals during neuroprosthetic learning" by Clancy et al., Nature Neurosci. 17:807-809.*
35. Chase SM (2012) Single spikes may suffice. *J Neurophysiol.* 108:1809-1809. *Commissioned commentary (Editorial Focus) on "Comparison of latency and rate coding for the direction of whisker deflection in the subcortical somatosensory pathway" by Storchi et al., J. Neurophysiol. 108:1810-1821.*
36. Chase SM and Schwartz AB (2011) Inference from populations: going beyond models. In: *Enhancing performance for Action and Perception, Progress in Brain Research Volume 192:103-112* (Green AC, Chapman, E, Kalaska JF, & Lepore F, eds).
37. Guger C, Bin G, Gao X, Guo J, Hong B, Liu T, Gao S, Guan C, Ang KK, Phua KS, Wang C, Chin ZY, Zhang H, Lin R, Chua KSG, Kuah C, Ang BT, George H, Kübler A, Halder S, Hösle A, Münßinger J, Palatucci M, Pomerleau D, Hinton G, Mitchell T, Ryan DB, Sellers EW, Townsend G, Chase SM, Whitford AS, Schwartz AB, Kawashima K, Shindo K, Ushiba J, Liu M and Schalk G (2011) State of the art in BCI research: BCI award 2010. In: *Recent Advances in Brain-Computer Interfaces* (Fazel R, ed).

### **Reviews & Interviews About My Work**

38. Galgali AR and Mante V (*in press*). Set in one's thoughts.  
[Review of Golub et al., *Nature Neuro*, *in press*]
39. Whalley K (2014). Learning and memory: Putting limits on learning. *Nature Reviews Neuroscience* 15:631.  
[Review of Sadtler et al., *Nature*, 2014]
40. Upson, S (2014) Cyborg confidential. *SA Mind* 25(6):30-35.

## DISSERTATIONS AND THESES

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- Ravikumar S (2017) Tracking chronically recorded neurons using pairwise cross-correlograms. MS Thesis, Biomedical Engineering, Carnegie Mellon University.
- Sharma A (2017) Design of a split-running wheel for studies of locomotor learning. MS Thesis, Biomedical Engineering, Carnegie Mellon University. (co-advised by Aryn Gittis)
- Jeon B (2016) Design and testing of a closed-loop brain-computer interface system for operation by a mouse. MS Thesis, Biomedical Engineering, Carnegie Mellon University. (co-advised by Sandra Kuhlman)
- Golub MD (2015) Interpreting neural population activity during feedback motor control. PhD Dissertation, Electrical and Computer Engineering, Carnegie Mellon University. (co-advised by Byron Yu)
- Lund P (2014) Predicting high-dimensional neural activity patterns during brain-computer interface control. MS Thesis, Machine Learning, Carnegie Mellon University. (co-advised by Byron Yu)
- Zhao Y (2014) An extended latent Kalman filter for nuisance variable removal in brain-computer interface decoding applications. MS Thesis, Biomedical Engineering, Carnegie Mellon University.
- Chase SM (2006) The representation of sound localization information among neural populations in the inferior colliculus. PhD Dissertation, Biomedical Engineering, Johns Hopkins University. (Advisor: ED Young)
- Chase SM (1999) A micromechanical red-shifting tunable vertical cavity filter. MS Thesis, Electrical Engineering, University of California, Berkeley. (Advisor: CJ Chang-Hasnain)

## PROFESSIONAL ACTIVITIES

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Co-director, Program in Neural Computation

### ***Workshop organization & Committee service***

Program Committee, Cosyne 2018.

BCI 2016 Workshop organizer, “Algorithms and performance using implanted devices.”

BCI 2016 Workshop organizer, “Studying learning with brain-computer interfaces.”

Translational and Computational Motor Control Workshop program committee, 2015-2017.

Co-chair: Platform session on neural computation & statistical analysis of neural data, BMES 2009.

### ***Review activities***

Grant review: FNRS (Fonds de la Recherche Scientifique, Belgium), 2017 (twice).

Grant review: NSF BIO-IOS review panel, 2016.

Grant review: Department of Defense Peer Reviewed Medical Research Program (PRMRP), 2015.

Guest editor, PLoS Comp Bio, 2015-2016.



Ad-hoc reviewer for: American Controls Conference, Biological Cybernetics, Cerebral Cortex, Computational Methods and Programs in Biomedicine, Current Biology, Current Opinions in Neurobiology, eLife, Frontiers in Neuroscience, IEEE Engineering in Medicine and Biology Society, IEEE Signal Processing Letters, IEEE Transactions on Biomedical Engineering, IEEE Transactions on Neural Systems and Rehabilitation Engineering, Journal of the Association for Research in Otolaryngology, Journal of Neural Engineering, Journal of Neurophysiology, Journal of Neuroscience, Journal of Neuroscience Methods, Nature Biomedical Engineering, Nature Communications, Nature Medicine, Nature Neuroscience, Neural Computation, Neurobiology of Disease, Neuroinformatics, Neuroscience, Neuron, PLOS Computational Biology, PLOS One, PNAS, Science, Science and Translational Medicine, and Scientific Reports.

### ***Scientific Societies***

Founding Member: BCI Society.

Member: AAAS, APS, SfN.

## **SERVICE AND OUTREACH**

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### ***Science Briefings & General Press Interviews***

- 02/2018 Quoted in the Brown Daily Herald, “University study improves interfaces between brain, computers.”
- 05/2017 Quoted in WIRED, “Want a true bionic limb? Good luck without machine learning.”
- 04/2017 Contributed an ‘Expert Views’ piece to an article published by AXIOS, “When computers merge with our minds.”
- 02/2016 Templeton D “CMU study explores why we make mistakes,” Pittsburgh Post-Gazette.
- 12/2015 Press release about my work “Researchers gain understanding of why the brain makes mistakes,” picked up by MedicalXpress (and shared by Neuroscience News, Science Beta, and DeepStuff.org).
- 05/2015 Science Briefing, Heinz Foundation
- 03/2014 Science Briefing, Congressman Chaka Fattah
- 07/2013 Interview, IGN (an online news service)
- 03/2013 Science Briefing, Hillman Foundation
- 10/2012 Science Briefing, Hillman Foundation

### ***Student-Organized Activities***

- 10/2016 Speaker, Society of Women Engineers high school outreach day
- 04/2014 Panelist, CNBC Panel, “Graduate Academic Job Search”
- 06/2013 Mentor, CNBC Data Blitz
- 05/2012 Panelist, GBMES Panel, “Discussions at the Interface of Nature & Technology”

### ***Other***

- 09/2017 Panelist, Young Investigator Grants information session

- 08/2017 Panelist, Work/Life Balance workshop
- 05/2017 Panelist, NSF CAREER writing workshop
- 03/2017 Judge, Pittsburgh Regional Science & Engineering Fair
- 08/2016 Speaker, Andrew Carnegie Society
- 02/2016 Instructor, OSHER lifelong learning course
- 03/2014 Judge, Pittsburgh Regional Science & Engineering Fair
- 02/2012 Organizer, Biosignals Day Symposium, “Power in numbers: How many neurons are needed to...?”

## **PRESENTATIONS**

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### ***Invited Talks***

1. 2017. Oregon Health & Science University, Portland, OR. Invited to give two classroom lectures on motor system function and brain-machine interfaces.
2. 2017. TEDxCMU Pittsburgh, PA. “The limits of learnability.”
3. 2016. UPMC Enterprises, Pittsburgh, PA. “State-of-the-art in intracortical brain-computer interfaces.”
4. 2016. Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA. “Cognitive factors that shape neural prosthetic control.”
5. 2016. Department of Biomedical Engineering, University of Rochester, Rochester, NY. “Cognitive factors in neural prosthetic control.”
6. 2015. International Neuropsychological Symposium, Collioure, France. “Internal conceptions of external systems.”
7. 2015. Center for Neural Engineering Prostheses and Redwood Center for Theoretical Neuroscience, UC Berkeley, Berkeley, CA. “Internal models for interpreting neural population activity.”
8. 2014. SASP-SSP Continuing Education Symposium, Pittsburgh, PA. “From BrainHub to brain-computer interfaces: new research initiatives at Carnegie Mellon.”
9. 2014. Johns Hopkins Biomedical Engineering Retreat, Ocean City, MD. “From goats to brain-computer interfaces.”
10. 2014. Computational Motor Control Workshop, Beer-Sheva, Israel. “Internal model mismatch is responsible for the majority of errors in neuroprosthetic control.”
11. 2013. 2nd Annual Next Generation Medical Imaging Workshop, Pittsburgh, PA. “Movement-related information conveyed by non-traditional signal sources in motor cortex.”
12. 2013. Fourth Annual Aspen Brain Forum, Aspen, CO. “Developing algorithms for enhanced brain-machine interfaces.”
13. 2013. International BCI Meeting, Pacific Grove, CA. “Visuomotor adaptation in BCI: differences and similarities from natural reaching.”
14. 2011. The IEEE Pittsburgh Section Signal Processing and EMBS Chapters, Pittsburgh, PA. “Important and unimportant factors in neural prosthetic control.”

15. 2011. George Mason University, Fairfax, VA. “Visuomotor adaptation observed through a brain-computer interface.”
16. 2011. Harvard University, Cambridge, MA. “Visuomotor adaptation observed through a brain-computer interface.”
17. 2011. Boston University, Boston, MA. “Visuomotor adaptation observed through a brain-computer interface.”
18. 2010. CNUP Annual Retreat, Wheeling, WV. “Visuomotor adaptation observed through a brain-computer interface.”
19. 2010. Computational Motor Control Workshop, Beer-Sheva, Israel. “Visuomotor adaptation observed through a brain-computer interface.”
20. 2010. Hebrew University, Jerusalem, Israel. “Visuomotor adaptation observed through a brain-computer interface.”
21. 2010. Johns Hopkins Applied Physics Laboratory, Laurel, MD. “Important and unimportant factors in neural prosthetic control.”
22. 2009. Nertworks: a BMES satellite meeting, Pittsburgh, PA. “Leveraging BCI paradigms to study neural plasticity.”
23. 2009. McGowan Institute Annual Retreat, Farmington, PA. “Advances in neural prosthetic control.”

### **Conference Presentations**

#### 2018

1. Oby E, Golub M, Hennig J, Degenhart A, Tyler-Kabara E, \*Yu B, \*Chase **SM**, \*Batista A (2018). Learning can generate new patterns of neural population activity. Cosyne annual meeting. [Accepted as a talk: 4% acceptance rate.]
2. Bishop W, Crowder E, Zandvakili A, Zhou X, **Chase SM**, Kohn A, Olson C, and Yu B (2018). Leveraging low-dimensional structure in neural population activity to combine neural recordings. Cosyne annual meeting.

#### 2017

3. Bahureksa L, Joiner W, **Chase SM** (2017) Comparing M1 neural reorganization during contralateral and ipsilateral visuomotor rotation learning. SfN annual meeting.
4. Zhou W, Colucci-Chang K, **Chase SM**, Joiner WM (2017) Dissociating the influence of postural and visual shifts on the transfer of motor adaptation to novel workspace locations. SfN annual meeting.
5. Jeon B, Quick K, **Chase SM**, Kuhlman SF (2017) Stability of orientation and spatial frequency tuning in mouse primary visual cortex. SfN annual meeting.
6. Stan P, Kauttonen J, Jeon B, **Chase SM**, Lee TS, Kuhlman SF (2017) Primary visual cortex encodes orientation-invariant attributes of complex images. SfN annual meeting.
7. <sup>+</sup>Bishop W, <sup>+</sup>Degenhart A, Oby ER, Tyler-Kabara EC, Batista AP, \*Chase **SM**, \*Yu BM (2017) Extracting stable representations of neural population state from unstable neural recordings. SAND 8 Workshop.

8. Joiner WM, Colucci-Chang K, Zhou W, and **Chase SM** (2017) Dissociating the influence of postural and visual shifts on the transfer of motor adaptation to novel workspace locations. NCM annual meeting.
9. Hennig JA, Golub MD, Lund PJ, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \*Yu BM, \***Chase SM** (2017) Predicting neural activity in behaviorally irrelevant dimensions. Cosyne annual meeting.
10. <sup>+</sup>Bishop W, <sup>+</sup>Degenhart A, Oby ER, Tyler-Kabara EC, \***Chase SM**, \*Batista AP, \*Yu BM (2017) Extracting stable representations of neural population state from unstable neural recordings. Cosyne annual meeting.
11. Golub MD, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \***Chase SM**, \*Yu BM (2017) Learning by neural reassociation. Cosyne annual meeting.

### 2016

12. Golub MD, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \***Chase SM**, \*Yu BM (2016) Learning by neural reassociation. Brain-Initiative PI meeting.
13. Flesher SN, Downey JE, Weiss J, Tyler-Kabara EC, **Chase SM**, Schwartz AB, Boninger ML, Collinger JL, Gaunt RA (2016) Grasp Force Control with Somatosensory Feedback in a Brain–Computer Interface. Brain-Initiative PI meeting.
14. Hennig JA, Golub MD, Lund PJ, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \*Yu BM, \***Chase SM** (2016). Predicting neural activity in behaviorally irrelevant dimensions. SfN annual meeting.
15. Golub MD, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \***Chase SM**, \*Yu BM (2016) Population-level changes in neural activity during learning. SfN annual meeting.
16. <sup>+</sup>Degenhart A, <sup>+</sup>Bishop W, Oby ER, Tyler-Kabara EC, Batista AP, \***Chase SM**, \*Yu BM (2016). Self-recalibrating brain-computer interfaces based on population subspace alignment. SfN annual meeting.
17. Oby ER, Degenhart A, Tyler-Kabara E, Yu B, **Chase SM**, and Batista AP (2016) Learning to generate new patterns of neural activity. Brain Day, University of Pittsburgh.
18. <sup>+</sup>Degenhart A, <sup>+</sup>Bishop W, Oby ER, Tyler-Kabara EC, Batista AP, \***Chase SM**, \*Yu BM (2016). Self-recalibrating brain-computer interfaces based on population subspace alignment. Brain Day, University of Pittsburgh.
19. Zhang Y and **Chase SM** (2016). A control-theoretic approach to brain-computer interface design. American Controls Conference 2016.
20. **Chase SM** (2016) Provably optimal design of intracortical BCI decoding algorithms. BCI 2016 workshop, “Algorithms and performance using implanted devices” organized by Chase, Batista, Yu, and Carmena.
21. Zhou X, Tien R, and **Chase SM** (2016) Distinct timescales of cortical reorganization in a long-term learning task. BCI 2016.
22. Golub MD, **Chase SM**, Batista AP, and Yu BM (2016) Brain-computer interfaces for dissecting cognitive processes underlying sensorimotor control. Complexity of Neural Computation and Cognition Workshop, Janelia Farms.

23. Oby ER, Degenhart A, Tyler-Kabara E, Yu B, **Chase SM**, and Batista AP (2016) Exploring learning-induced changes in neural population activity. NCM annual meeting.
24. Zhou X, Tien R, and **Chase SM** (2016) Distinct timescales of cortical reorganization in a long-term learning task. Cosyne annual meeting.
25. Bittner S, Williamson RC, Snyder AC, Litwin-Kumar A, Doiron B, \***Chase SM**, \*Smith MA, and \*Yu BM (2016) Effects of excitatory versus inhibitory neuron sampling on outputs of dimensionality reduction. Cosyne annual meeting.
26. Golub MD, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \***Chase SM**, and \*Yu BM (2016) Learning engages both high- and low-covariance modes of neural population activity. Cosyne annual meeting.
27. Golub MD, Sadtler PT, Quick KM, Ryu SI, Tyler-Kabara EC, Batista AP, \***Chase SM**, and \*Yu BM (2016) Population-level changes in neural activity during learning. Cosyne workshop, “Sensorimotor learning through multi-dimensional spaces” organized by Golub.

#### 2015

28. Oby ER, \***Chase SM**, \*Yu BM, \*Batista AP (2015) Exploring learning-induced changes in neural manifolds. Brain Initiative PI meeting.
29. Zhou X, Tien R, and **Chase SM** (2015) Distinct timescales of cortical reorganization in a long-term learning task. TCMC workshop.
30. Alemayehu B, Pavlovsky N, Chiou J, **Chase SM**, and Batista AP (2015) Eye-centered tuning is weak in dorsal premotor cortex when monkeys are not trained to fixate. SfN annual meeting.
31. Zhou X, Tien R, and **Chase SM** (2015) Distinct timescales of cortical reorganization in a long-term learning task. SfN annual meeting.
32. Zhang Y and **Chase SM** (2015) Recasting brain-machine interface design from a physical control system perspective. SAND 7 Workshop.
33. Matano F, **Chase SM**, Shalizi C, and Ventura V (2015). Improved kinematic models for decoding neural activity. SAND 7 Workshop.
34. Golub MD, \*Yu BM, and \***Chase SM** (2015) Internal models for interpreting neural population activity during sensorimotor control. McGovern Institute Spring Symposium.
35. Golub MD, \*Yu BM, and \***Chase SM** (2015) Internal models for interpreting neural population activity during sensorimotor control. Cosyne annual meeting.

#### 2014

36. Kappel D, Pecevski D, Whitford AS, **Chase SM**, Maass W (2014). Stochastic motor control as probabilistic inference in spiking neural networks with noise. SfN annual meeting.
37. Rasmussen RG, **Chase SM**, Schwartz AB (2014). Limits on transmission of information in primary motor cortex during multidimensional reaches. SfN annual meeting.
38. Suway SB, McMorland AJC, Fraser GW, Sohn JW, **Chase SM**, Liu Z, Velliste M, Kass RE, Schwartz AB (2014) Short time-scale stability of directional tuning in motor cortex measured using maximum likelihood estimation. SfN annual meeting.
39. Rasmussen RG, Swartz AB, and **Chase SM** (2014). Dynamic range adaptation in motor cortical neurons. Cosyne annual meeting.

2013

40. Perel S, Sadtler PT, Ryu SI, Batista AP, **Chase SM** (2013). Tuning to reach kinematics of single-unit activity, threshold-crossings, and local field potentials in motor cortex. SfN annual meeting.
41. Alemayehu B, Pavlovsky N, Tyler-Kabara EC, **Chase SM**, Batista A (2013). Neurons in monkey dorsal premotor cortex are weakly sensitive to eye position when gaze fixation is untrained. SfN annual meeting.
42. Zhang Y and **Chase SM** (2013) A stabilized dual Kalman filter for adaptive tracking of brain-computer interface decoding parameters. EMBC.
43. Perel S, Sadtler PT, Godlove JM, Ryu SI, Wang W, Batista AP, **Chase SM** (2013) Direction and speed tuning of motor-cortex multi-unit activity and local field potentials during reaching movements. EMBC.

2012

44. Todorova S, **Chase SM**, Ventura V (2012). Simple automatic spike sorting can improve the efficiency of decoding from neuron spike trains. WiML 2012, Lake Tahoe, NV.
45. Todorova S, **Chase SM**, Ventura V (2012). Model-Based Clustering of non-Poisson, non-homogenous Point Processes Events with Application to Neuroscience. 7th Annual Machine Learning Workshop of the NYAS. New York, NY.
46. Golub MD, \*Yu BM, and \***Chase SM** (2012) Internal models engaged by brain-computer interface control. SfN annual meeting.
47. Zhang Y, Schwartz AB, **Chase SM**, and Kass RE (2012) Bayesian learning in assisted brain-computer interface tasks. EMBC.
48. Golub MD, \*Yu BM, and \***Chase SM** (2012) Internal models engaged by brain-computer interface control. EMBC.
49. Golub MD, Yu BM, Schwartz AB, and **Chase SM** (2012) Enhanced stability of cursor stopping in brain-computer interfaces. EMBC.
50. Todorova S, **Chase SM**, and Ventura V (2012) Model-Based Clustering of non-Poisson, non-homogenous Point Processes Events with Application to Neuroscience. Classification Society Annual Meeting.
51. Golub MD, \***Chase SM**, and \*Yu BM (2012) Internal model estimation for closed-loop brain-computer interfaces. Young Investigator Talk, SAND 6 Workshop.
52. Todorova S, **Chase SM**, and Ventura V (2012) Simple automatic spike sorting methods improve decoding accuracy in a 3D movement task. SAND 6 Workshop.
53. Zhang Y, Schwartz AB, **Chase SM**, and Kass RE (2012) Bayesian learning in assisted brain-computer interface tasks. SAND 6 Workshop.
54. Golub MD, \***Chase SM**, and \*Yu BM (2012) Internal model estimation for feedback control in brain-computer interfaces. Cosyne annual meeting & Machine Learning, Statistical Inference, and Neuroscience, Janelia Farms.

2011

55. Rao H, Schwartz AB, and **Chase SM** (2011) Adaptation to visuomotor gains applied through a brain-computer interface. SfN annual meeting.

56. Golub MD, Yu BM, Schwartz AB, and **Chase SM** (2011) Improving cursor stops in closed-loop brain-computer interfaces by leveraging trajectory curvature. SfN annual meeting.

2010

57. **Chase SM**, Whitford AS, Kass RE, and Schwartz AB (2010) Operant conditioning to identify volitionally controllable patterns of neural activity. SfN annual meeting.
58. Whitford AS, **Chase SM**, and Schwartz AB (2010) Coordination and control of cortical activity patterns identified via operant conditioning. SfN annual meeting.
59. McMorland AJC, Liu Z, **Chase SM**, Velliste M, Kass RE, and Schwartz AB (2010) Towards better prediction of temporal dynamics of M1 firing rates during reaching. SfN annual meeting.
60. **Chase SM**, Kass RE, and Schwartz AB (2010) Differentiating global and local adaptation responses to visuomotor rotations of a brain-computer interface. CNS10 Workshop.
61. **Chase SM** (2010) Separating intention from action in motor cortical tuning curves. Young Investigator Talk, SAND 5 Workshop.

2009

62. Legenstein R, **Chase SM**, Schwartz AB, and Maass W (2009) A reward-modulated Hebbian learning rule can explain experimentally observed network reorganization in a brain control task. NIPS
63. **Chase SM**, Schwartz AB, and Kass RE (2009) Adaptive gain modulation in the motor system observed through a brain-computer interface. SfN annual meeting.
64. Whitford AS, **Chase SM**, and Schwartz AB (2009) Task-specific tuning properties of motor cortical units used to control a brain-computer interface. SfN annual meeting.
65. Fraser GW, **Chase SM**, Koyama S, Kass RE, and Schwartz AB (2009) Important and unimportant factors for neural prosthetic control. SfN annual meeting.
66. **Chase SM**, Schwartz AB, and Kass RE (2009) Computational approaches for investigating network adaptive behavior in a brain-computer interface. BMES annual meeting.
67. **Chase SM**, Kass RE, and Schwartz AB (2009) Recent advances in neural prosthetic control. BMES annual meeting.
68. Schwartz AB, Kass RE, and **Chase SM** (2009) Learning and decoding in a multielectrode brain-machine interface paradigm. CRCNS PI meeting.
69. Koyama S, **Chase SM**, Whitford A, Velliste M, Schwartz AB, and Kass RE (2009) Comparison between decoding algorithms in open-loop and closed-loop performance. Cosyne annual meeting.

2008

70. **Chase SM**, Kass RE, and Schwartz AB (2008) A framework for modeling the closed-loop performance of brain-computer interface algorithms. SfN annual meeting.
71. Legenstein R, **Chase SM**, Schwartz AB, and Maass W (2008) A model for learning effects in motor cortex that may facilitate the brain control of neuroprosthetic devices. SfN annual meeting.

72. Koyama S, Whitford A, **Chase SM**, Velliste M, Schwartz AB, and Kass RE (2008) Recursive Bayesian algorithms for real-time cortical control of 3D neuroprosthetic devices. SfN annual meeting.
73. **Chase SM**, Schwartz AB, and Kass RE (2008) General adaptation strategies used to compensate for perturbations of a brain-computer interface. SAND 4 Workshop.

pre-2008

74. **Chase SM**, Fraser GW, Kass RE, and Schwartz AB (2007) Neural adaptation to a 3-dimensional, rotation perturbation in a closed loop brain-computer interface. SfN annual meeting.
75. **Chase SM**, Kass RE, and Schwartz AB (2007) BCI – A novel paradigm for studies of neural plasticity. BMES annual meeting.
76. **Chase SM**, Fraser GW, Kass RE, and Schwartz AB (2007) Neural adaptation to a 2-dimensional rotation perturbation in a closed loop brain-computer interface. CRCNS PI meeting.
77. **Chase SM** and Young ED (2006) Using a population reference for stimulus onset time in first spike latency coding. Cosyne annual meeting.
78. **Chase SM** and Young ED (2005) Spike timing dependent information on sound location in the inferior colliculus. SfN annual meeting.
79. **Chase SM** and Young ED (2005) The representation of sound location information among neural populations in the inferior colliculus ARO 28th midwinter meeting.
80. **Chase SM** and Young ED (2004) The processing of sound location cues by classes of units in the inferior colliculus. ARO 27th midwinter meeting.