

Jonathan A. Michaels

Brain and Mind Western Interdisciplinary Research Building London, Ontario, Canada, N6A 5B7	jonathan.michaels@uwo.ca www.JMichaels.me 519-521-1262
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Education

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| 2017 | Dr. rer. nat. Systems Neuroscience (summa cum laude), GGNB, Georg-August-Universität Göttingen.
Dissertation: Towards population coding principles in the primate premotor and parietal grasping network |
| 2011 | Bachelor of Science (Honours), Queen's University, Kingston, Canada.
Dissertation: Influence of water maze learning on low-frequency-induced synaptic potentiation in the rat hippocampus |

Research Experience

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| 7/2024 | Assistant Professor, School of Kinesiology & Health Science, Faculty of Health, York University, Toronto, Canada |
| 6/2019 – Present | Postdoctoral Fellow, Laboratory of Andrew Pruszynski, Brain and Mind at Western, Western University, London, Canada |
| 5/2017 – 5/2019 | Postdoctoral Fellow, Laboratory of Krishna V Shenoy, Howard Hughes Medical Institute at Stanford University, California, USA. |
| 1/2017 – 5/2017 | Transitional Postdoctoral Fellow, Neurobiology Lab of Hansjörg Scherberger, German Primate Center, Göttingen, Germany. |
| 9/2011 – 1/2017 | Graduate Student, Neurobiology Lab of Hansjörg Scherberger, German Primate Center, Göttingen, Germany. |
| 9/2010 – 5/2011 | Bachelor Student, Neuroplasticity Lab of Hans C. Dringenberg, Queen's University, Kingston, Canada. |
| 5/2009 – 8/2011 | Undergraduate Researcher, Integrative Motor Behaviour Lab of Stephen H. Scott, Queen's University, Kingston, Canada. |
| 9/2008 – 5/2009 | Research Assistant, Language and Cognition Lab of Stanka A. Fitneva, Queen's University, Kingston, Canada. |

Fellowships and Grants

- BrainsCAN Postdoctoral Fellowship – Tier I, \$110,000 (2021 – 2024)
- Michaels, JA (co-lead), Versteeg, C (co-lead). Simons-Emory Collaborator Accelerator Grant, \$68,000 (2022-2023)
- Vector Institute Postgraduate Affiliate, \$12,000 (2021 – 2023)
- Diedrichsen, J (co-PI), Pruszynski, JA (co-PI), Michaels, JA (Collaborator). CIHR Project Grant, \$952,425 (2021 – 2026). Neural control of sequential action: Controlling the present while planning the future
- Banting Postdoctoral Fellowship, \$140,000, (2021 – 2023)
- BrainsCAN Postdoctoral Fellowship – Tier II, \$97,000 (2019 – 2021)

Human Frontier Science Program Long-Term Fellow, \$230,000 (2018 – 2021)

Awards and Honours

Sloan-Swartz Travel Scholarship (2016)

Neural Control of Movement Travel Scholarship (2016)

Doctoral Thesis awarded “summa cum laude” (2016)

Dean’s Honour List, Queen’s University, Kingston, Canada (2009 – 2011)

Peer-Reviewed Publications

Michaels JA, Schaffelhofer S, Agudelo-Toro A, Scherberger H (2020). A goal-driven modular neural network predicts parietofrontal neural dynamics during grasping. *Proceedings of the National Academy of Sciences of the United States of America*, 117(50). doi:10.1073/pnas.2005087117

Intveld RW, Dann B, Michaels JA, Scherberger H (2018). Neural coding of intended and executed grasp force in macaque areas AIP, F5, and M1. *Scientific Reports*, 8(17985). doi:10.1038/s41598-018-35488-z

Michaels JA*, Dann B*, Intveld RW, Scherberger H (2018). Neural Dynamics of Variable Grasp-Movement Preparation in the Macaque Frontoparietal Network. *Journal of Neuroscience*, 38(25), 5759–5773. doi:10.1523/JNEUROSCI.2557-17.2018

Michaels JA, Scherberger H (2018). Population coding of grasp and laterality-related information in the macaque fronto-parietal network. *Scientific Reports*, 8(1710). doi:10.1038/s41598-018-20051-7

Michaels JA, Dann B, Scherberger H (2016). Neural population dynamics during reaching are better explained by a dynamical system than representational tuning. *PLOS Computational Biology*, 12(11), e1005175. doi:10.1371/journal.pcbi.1005175

Michaels JA, Scherberger H (2016). hebbRNN: A reward-modulated Hebbian learning rule for recurrent neural networks. *The Journal of Open Source Software*. doi:10.21105/joss.00060

Dann B, Michaels JA, Schaffelhofer S, Scherberger H (2016). Uniting functional network topology and oscillations in the fronto-parietal single unit network of behaving primates. *eLife*. doi:10.7554/eLife.15719

Michaels JA, Dann B, Intveld RW, Scherberger H (2015). Predicting reaction time from the neural state space of the premotor and parietal grasping network. *Journal of Neuroscience*, 35(32), 11415–11432. doi:10.1523/JNEUROSCI.1714-15.2015

Yang L, Michaels JA, Pruszynski JA, Scott SH (2011). Rapid motor responses quickly integrate visuospatial task constraints. *Experimental Brain Research*, 211(2): 231–242. doi:10.1007/s00221-011-2674-3

In progress publications

- Codol O, Michaels JA, Kashefi M, Pruszynski JA, Gribble PL (2023). MotorNet: a Python toolbox for controlling differentiable biomechanical effectors with artificial neural networks. *eLife* (in review).
- Chung B, Zia M, Thomas K, Michaels JA, ... (46 authors) ..., Sober S (2023). Myomatrix arrays for high-definition muscle recording. *eLife* (in review).

Other Publications

- Codol O, Ariani G, Michaels JA (2020). Aiming for stable control. *Nature Neuroscience (News & Views)*, 23(3), 298-300. doi:10.1038/s41593-020-0601-2
- Dann B, Michaels JA, Scherberger H (2016). Separable decoding of cue, intention, and movement information from the fronto-parietal grasping-network. *Proceedings of the Sixth International Brain-Computer Interface Meeting: BCI Past, Present, and Future*, 218. doi:10.3217/978-3-85125-467-9

Talks

- Sensory predictions are embedded in cortical motor activity (virtual). Canadian Neuroscience Seminar – Postdoctoral Series. May 4th, 2023.
- Motor cortex state appropriately integrates sensory feedback (invited talk). Simons-Emory International Consortium on Motor Control Meeting. Atlanta, GA, USA. October 4th, 2022.
- A distributed circuit for regulating feedback control policy. 32nd Neural Control of Movement Conference. Dublin, Ireland. July 26th, 2022
- From vision to action in the primate grasping circuit (invited talk, virtual). Department of Kinesiology and Health Sciences, York University. April 11th, 2022
- Simultaneous high-density recording of cortical neurons and motor units in non-human primates (invited talk, virtual). Simons-Emory International Consortium on Motor Control Meeting. February 25th, 2022
- From vision to action in the primate grasping circuit (invited talk, virtual). Department of Biomedical and Molecular Sciences, Queen's University. January 20th, 2022
- Rapid motor responses reflect explicit sensory priors (blitz talk, virtual). 31st Neural Control of Movement Conference. April 20th, 2021
- Combining deep learning a primate electrophysiology to understand reach and grasp control (invited talk, virtual). Quantitative Life Sciences Seminar Series, McGill University. April 6th, 2021
- Combining deep learning a primate electrophysiology to understand reach and grasp control (invited talk, virtual). Université de Montréal. February 23rd, 2021
- Combining deep learning a primate electrophysiology to understand reach and grasp control (invited talk, virtual). Facebook AI – Brain & AI Meeting. January 27th, 2021

- Combining deep learning a primate electrophysiology to understand reach and grasp control (invited talk, virtual). Behavioural Neuroscience and Neuroprosthetics Lab Journal Club. November 27th, 2020
- Combining deep learning a primate electrophysiology to understand reach and grasp control (invited talk, virtual). Simons-Emory International Consortium on Motor Control Meeting. October 8th, 2020
- Combining deep learning a primate electrophysiology to understand reach and grasp control (invited talk, virtual). Barcelona Computational, Cognitive and Systems Neuroscience Community Webinar. July 1st, 2020
- A goal-driven modular neural network predicts parieto-frontal neural dynamics during grasping (short talk, virtual). Neuromatch 2.0. May 27th, 2020
- A modular neural network model of grasp movement generation (workshop talk). COSYNE 2020. Breckenridge, CO, March 3rd, 2020
- Combining deep learning a primate electrophysiology to understand reach and grasp control (Departmental Seminar). University of Western Ontario Physiology and Pharmacology Department, London, ON, Canada. January 20th, 2020
- WHAT'S IN THE BOX? - Interpretable neural nets for movement control (Workshop talk). COSYNE 2018. Breckenridge, CO, USA. March 6th, 2018
- Performance-driven recurrent neural networks for complex motor control (Workshop talk). COSYNE 2018. Breckenridge, CO, USA. March 5th, 2018
- Performance-driven recurrent neural networks for complex motor control (invited talk). Numenta. Redwood City, CA, USA. November 29th, 2017
- A modular neural network model of the primate grasping circuit (nanosymposium). Annual Meeting of the Society for Neuroscience. Washington, DC, USA. November 14th, 2017
- A recurrent neural network model of the visuomotor grasp generation circuit (nanosymposium). Annual Meeting of the Society for Neuroscience. San Diego, CA, USA. November 16th, 2016
- Continuous decoding of hand grips with a high dimensional brain computer interface (nanosymposium, presenting in place of Andres Agudelo-Toro). Annual Meeting of the Society for Neuroscience. San Diego, CA, USA. November 16th, 2016
- A recurrent neural network model of the visuomotor grasp generation circuit. Sloan-Swartz Centers for Theoretical Neurobiology Annual Meeting. Pasadena, CA, USA. August 3rd, 2016. Travel grant awarded
- Probing and modeling the continuum of immediate to withheld grasping movements in the macaque fronto-parietal network (invited talk). Neural-Prosthetic Systems Laboratory. Stanford, CA, USA. May 24th, 2016
- Probing the continuum of immediate to withheld grasping movements in the macaque fronto-parietal network. 26th Neural Control of Movement Conference. Montego Bay, Jamaica. April 26th, 2016
- Grasping with and without motor preparation (nanosymposium). 45th Annual Meeting of the Society for Neuroscience. Chicago, IL, USA. October 20th, 2015. Travel grant awarded

Laterality of grasp-related activity in macaque areas AIP and F5. 8th Primate Neurobiology Meeting. Göttingen, Germany. March 18th, 2015

Single trial neural correlates of grasping movement preparation in macaque areas AIP and F5. 24th Neural Control of Movement Conference. Amsterdam, Netherlands. April 24th, 2014

Posters (as presenter)

Michaels JA, Kashefi M, Zheng J, Codol O, Weiler J, Kersten R, Pruszynski JA (2023). Sensory predictions are embedded in cortical motor activity. COSYNE 2023. Montreal, QC, Canada.

Michaels JA, Zheng J, Codol O, Weiler J, Pruszynski JA (2021). Long-latency feedback responses reflect explicit sensory priors. Annual Meeting of the Society for Neuroscience. Virtual.

Michaels JA, Schaffelhofer S, Agudelo-Toro A, Scherberger H (2018). A modular neural network model of the primate grasping circuit. COSYNE 2018. Denver, CO, USA

Michaels JA, Schaffelhofer S, Agudelo-Toro A, Scherberger H (2017). A modular neural network model of the primate grasping circuit. 27th Neural Control of Movement Conference. Dublin, Ireland

Michaels JA, Dann B, Scherberger H (2016). Emergent properties in a dynamical model of movement generation. 9th Primate Neurobiology Meeting. Tübingen, Germany

Michaels JA, Scherberger H. Laterality of grasp-related activity in macaque areas AIP and F5 (2015). 11th Göttingen Meeting of the German Neuroscience Society. Göttingen, Germany

Michaels JA, Scherberger H. Laterality of grasp-related activity in macaque areas AIP and F5 (2014). Annual Meeting of the Society for Neuroscience. Washington, DC, USA. Travel grant awarded

Michaels JA, Wellner B, Scherberger H (2014). Single trial neural correlates of grasping movement preparation in macaque areas AIP and F5. 7th Primate Neurobiology Meeting. Tübingen, Germany

Michaels JA, Wellner B, Scherberger H (2013). Single trial neural correlates of grasping movement preparation in macaque areas AIP and F5. Annual Meeting of the Society for Neuroscience. San Diego, CA, USA. Travel grant awarded

Michaels JA, Wellner B, Scherberger H (2013). Single trial neural correlates of grasping movement preparation in macaque areas AIP and F5. EPFL Life Science Symposium (LSS). Lausanne, Switzerland

Teaching, Mentorship, and Service

Guest lecture (virtual), Computational Modeling of Animal Movement (2021). University of Colorado, CO, USA. April 13th, 2021

Teaching assistant, Motor Systems Lecture & Seminar (2013). University of Göttingen, Germany

Mentorship/Advisory activities:

- Master's Thesis mentor of Justin Zhou, Western Neuroscience Graduate Program. Western University, London, ON, Canada
- Graduate mentor of Sonia Yasmin, Western Neuroscience Graduate Program. Western University, London, ON, Canada
- Graduate mentor of Mehrdad Kashefi, Western Neuroscience Graduate Program. Western University, London, ON, Canada
- Undergraduate Thesis mentor of Jack Zheng, Title: Long-latency muscle response scales with the instructed probability of the direction of a mechanical perturbation (2019-2020). Western University, London, ON, Canada
- Graduate mentor of Avery Krieger, Stanford Neuroscience Program (2017-2018). Stanford University, Stanford, CA, USA
- Master's Thesis mentor of Luis Ángel Pardo Sánchez, Title: A recurrent neural network model of bimanual coordination and interference (2016-2017). University of Göttingen, Göttingen, Germany
- Bachelor Thesis mentor of Roman Eppinger, Title: State space analysis and visualization of neuronal data in a delayed grasping task (2015). University of Göttingen, Göttingen, Germany

Science Meets Parliament Delegate (2023)

Neural mechanisms of sequence learning and execution COSYNE Workshop co-organizer (2023)

CIHR Doctoral Competition Peer Reviewer (2021-2023)

Neuromatch Academy Project Mentor (2021)

Postdoctoral Representative – EDI Committee, Department of Physiology and Pharmacology, Western University (2021-2022)

Banting Postdoctoral Fellowship Internal Review Committee (2021). Western University, London, ON, Canada

German Primate Center Colloquium Series Committee (2014-2016). German Primate Center, Germany

Reviewed for: Neuron, Nature, Nature Neuroscience, Nature Human Behavior, Nature Communications, The Journal of Neuroscience, The Journal of Neural Engineering, PLOS Comp Biol, NeurlPS

Workshop Participation

EDI and Anti-racism in Higher Education Workshop (2021). University of Western Ontario, London, ON, Canada

FieldTrip Workshop (2014). Göttingen, Germany

Tübingen International Summer School for Neuroenhancement (2013). Cloister Heiligkreuztal, Germany

NWG Practical Course – Transcranial Magnetic and Electrical Stimulation (2013). Göttingen, Germany

BBCI Summer School: Brain-Computer Interfacing and Neurotechnology (2012). Berlin, Germany

Nerve Cell Culture and Patch-Clamp Recording (2012). Göttingen, Germany

Bernstein R&D Workshop Cellular Electrophysiology (2012). Heidelberg, Germany

Career Interruptions

I have taken a total of 8 months of parental leave following the birth of my children (2016 and 2018). In this period I was fully absent from the lab, significantly delaying dissemination of research.

The laboratory where I pursued my first postdoctoral position (Shenoy Lab) made the necessary decision to cease all animal experimentation in September 2018 due to the health of the principal investigator. Following this development, I left this research environment and terminated a prestigious Human Frontier Science Program fellowship since I could not pursue my scientific goals.