Jonathan A. Michaels

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Neural Control & Computation Lab
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Education

2017	Dr. rer. nat. (Ph.D. Equivalent) Systems Neuroscience (summa cum laude), GGNB, Georg-August-Universität Göttingen
2011	Bachelor of Science (Honours), Queen's University, Kingston, Canada

Academic Employment

7/2024 – York University, Toronto, Canada
- Assistant Professor, School of Kinesiology & Health Science, Faculty of Health
- Associate Member, Department of Electrical Engineering and Computer Science, Lassonde School of Engineering
- Associate Member, Department of Biology, Faculty of Science

Fellowships and Scholarships

2021 – 2024	BrainsCAN Postdoctoral Fellowship – Tier I, $110,000
2021 – 2023	Vector Institute Postgraduate Affiliate, $12,000
2021 – 2023	Banting Postdoctoral Fellowship, $140,000 *Most competitive fellowship in Canada (~10% success rate for applicants after pre-selection by internal review at host institution)*
2019 – 2021	BrainsCAN Postdoctoral Fellowship – Tier II, $97,000
2018 – 2021	Human Frontier Science Program Long-Term Fellow, $230,000 *Competitive international fellowship (success rate ~5%)*

Research Funding

2024 – 2025	Michaels JA (PI). Collaboration on Motor Planning, Execution, and Resilience (COMPERE) Accelerator Grant with support from the Azrieli Foundation, $40,000 *Investigating when, where, why, and how movement preparation occurs in the nervous system*
2022 – 2023	Michaels, JA (co-lead), Versteeg, C (co-lead). Simons-Emory Collaborator Accelerator Grant, $68,000 *Understanding the computations that underlie complex motor behavior*
2021 – 2026	Diedrichsen, J (co-PI), Pruszynski, JA (co-PI), Michaels, JA (Collaborator). Canadian Institutes of Health Research, Project Grant, $952,425. *Neural control of sequential action: Controlling the present while planning the future*

Awards and Recognitions

2016	Sloan-Swartz Travel Scholarship
2016	Neural Control of Movement Travel Scholarship
2016	Doctoral Thesis awarded “summa cum laude”, the highest grade
2009 – 2011	Dean’s Honour List, Queen’s University, Kingston, Canada

Professional Activities

External Academic Leadership

- Founding Member, Canadian Non-Human Primate Consortium, 2023 –
- Panel organizer and speaker, Neural Control of Movement Conference, 2024
- COSYNE Program Committee, 2023 – 2025
- Science Meets Parliament Delegate, 2023
  Met with Members of Parliament / Senators in Ottawa to discuss science and policy
- COSYNE Workshop co-organizer, 2023
  Neural mechanisms of sequence learning and execution

Outreach

- Neuromatch Academy Project Mentor, 2021

Journal Reviewing

- eLife, Neuron, Nature, Nature Neuroscience, Nature Human Behavior, Nature Communications, The Journal of Neuroscience, PLOS Comp Biol

Conference Reviewing

- NeurIPS, COSYNE

Grant and Fellowship Reviewing

- CIHR Doctoral Competition, 2021 – 2023

Society Membership

- Society for the Neural Control of Movement
- Society for Neuroscience
- Canadian Association for Neuroscience

University Committees

- Banting Postdoctoral Fellowship Internal Review Committee, Western University, 2021

Departmental Committees

- Postdoctoral Representative, EDI Committee, Department of Physiology and Pharmacology, Western University, 2021 – 2024

Other Internal Committees

- Connected Minds (CFREF) Training Committee, 2023 – 2025
- German Primate Center Colloquium Series Committee, 2014 – 2016

Academic Defenses

- Justin Zhou, MSc Dissertation, Neuroscience, Western University, 2024 (Reader)

Advisory Committees

- Justin Zhou, MSc, Neuroscience, Western University, 2022 – 2024

Supervision

Postdoctoral Fellows

1. Sujaya Neupane, York University, 2024 –
   Funded by a Connected Minds Postdoctoral Fellowship
2. Daanish Mulla, York University, 2024 –
   Funded by an NSERC Postdoctoral Fellowship

Master's Students

1. Amirali Motaghedy, EECS, York University, 2024 –

Research Assistants

1. Mahdiyar Shahbazi, York University, 2024

Contributions to Teaching and Education

Course Instruction

2024 – HH/KINE 3650, Functional Neuroanatomy, York University
Didactic Lecture, ~36 hours per year, ~80 students

2025 – HH/KINE 4210, Disorders of Visual Cognition
Didactic Lecture and Seminar, ~36 hours per year, ~30 students

Guest Lecture

2021 Computational Modeling of Animal Movement, University of Colorado
Didactic Lecture, ~1.5 hours, ~20 students

Publications

Theses

1. Towards population coding principles in the primate premotor and parietal grasping network, PhD Thesis, GGNB, Department of Biology, Georg-August-Universität Göttingen, Germany
2. Influence of water maze learning on low-frequency-induced synaptic potentiation in the rat hippocampus, Undergraduate Honours Thesis, Department of Psychology, Queen's University, Canada

Articles

1. 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. doi:10.7554/eLife.88591.1
2. Chung B, Zia M, Thomas K, Michaels JA, … (46 authors) …, Sober S (2023). Myomatrix arrays for high-definition muscle recording. eLife. doi:10.7554/eLife.88551.1
3. 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
4. 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
5. 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

6. 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
7. 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
8. 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
9. 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
10. 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

Other Published Articles

1. Agudelo-Toro A, Michaels JA, Sheng WA, Scherberger H. Accurate neuroprosthetic control through latent state transition training (2023). *bioRxiv*. doi:10.1101/2023.06.02.543242 (invited for second revision at *Neuron*)
2. Funk A, Funston GF, Michaels JA, Moritz SC, Pereira EJ, Toombs E (2023). Building Better Bantings: Connecting Canada's Postdoctoral Fellows is critical for Canada's scientific future. *Canadian Science Policy Magazine*
3. 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

Selected Conference Proceedings

1. Shahbazi M, Kashefi M, Codol O, Michaels JA, Gribble P (2024). Using artificial neural networks to identify a neural basis of savings in motor learning, Neural Control of Movement Conference. Dubrovnik, Croatia
2. Ghavampour A, Sayyid S, Michaels JA, Orban De Xivry JJ, Pruszynski JA, Diedrichsen J (2024). What makes some chords hard to play? Exploring the role of muscle synergies, biomechanical and cognitive factors of difficulty. Neural Control of Movement Conference. Dubrovnik, Croatia
3. O'Connell S, Michaels JA, Wang R, Venkatesh M, Aresh N, Sober S, Pandarinath C (2024). EMUsort and LITMUS: the enhanced motor unit sorter and robust benchmarking of motor unit sorters. Neural Control of Movement Conference. Dubrovnik, Croatia
4. Zdun N, Michaels JA, Scherberger H, Dann B (2024). Visual activity modulates population dynamics during the initiation of identical grasp movements. Neural Control of Movement Conference. Dubrovnik, Croatia
5. Emanuele M, Pruszynski JA, Diedrichsen J, Michaels JA (2024). Rapid motor responses reflect probabilistic information about which finger will need to compensate for a mechanical perturbation. UK Sensorimotor Conference. Cambridge, UK. *Best poster award*
6. Michaels JA, Kashefi M, Zheng J, Codol O, Weiler J, Kersten R, Pruszynski JA (2023). Sensory predictions are embedded in cortical motor activity. Annual Meeting of the Society for Neuroscience. Washington, DC, USA
7. Michaels JA, Kashefi M, Zheng J, Codol O, Weiler J, Kersten R, Pruszynski JA (2023). Sensory predictions are embedded in cortical motor activity. Simian Collective Meeting. Chicago, IL, USA
8. Michaels JA, Kashefi M, Zheng J, Codol O, Weiler J, Kersten R, Pruszynski JA (2023). Sensory predictions are embedded in cortical motor activity. Canadian Association for Neuroscience Meeting. Montreal, QC, Canada

9. Michaels JA, Kashefi M, Zheng J, Codol O, Weiler J, Kersten R, Pruszynski JA (2023). Sensory predictions are embedded in cortical motor activity. Western Institute for Neuroscience Reception. London, ON, Canada
10. 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
11. 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
12. Michaels JA, Schaffelhofer S, Agudelo-Toro A, Scherberger H (2018). A modular neural network model of the primate grasping circuit. COSYNE. Denver, CO, USA
13. Michaels JA, Schaffelhofer S, Agudelo-Toro A, Scherberger H (2017). A modular neural network model of the primate grasping circuit. Neural Control of Movement Conference. Dublin, Ireland
14. Michaels JA, Dann B, Scherberger H (2016). Emergent properties in a dynamical model of movement generation. Primate Neurobiology Meeting. Tübingen, Germany
15. Michaels JA, Scherberger H. Laterality of grasp-related activity in macaque areas AIP and F5 (2015). Göttingen Meeting of the German Neuroscience Society. Göttingen, Germany
16. 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*
17. Michaels JA, Wellner B, Scherberger H (2014). Single trial neural correlates of grasping movement preparation in macaque areas AIP and F5. Primate Neurobiology Meeting. Tübingen, Germany
18. 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*
19. 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

Speaking Engagements

1. Sensory expectations shape neural activity during movement preparation. 34th Neural Control of Movement Conference. Dubrovnik, Croatia. April 16th, 2024 (invited)
2. Sensory predictions as a fundamental component of motor planning. Biology Department Seminar Series. York University. Jan 15th, 2024 (invited)
3. Sensory predictions are embedded in cortical motor activity (virtual). Canadian Neuroscience Seminar – Postdoctoral Series. May 4th, 2023 (invited)
4. Motor cortex state appropriately integrates sensory feedback. Simons-Emory International Consortium on Motor Control Meeting. Atlanta, GA, USA. October 4th, 2022 (invited)
5. A distributed circuit for regulating feedback control policy. 32nd Neural Control of Movement Conference. Dublin, Ireland. July 26th, 2022 (invited)
6. From vision to action in the primate grasping circuit (virtual). Department of Kinesiology and Health Sciences, York University. April 11th, 2022 (invited)
7. Simultaneous high-density recording of cortical neurons and motor units in non-human primates (virtual). Simons-Emory International Consortium on Motor Control Meeting. February 25th, 2022 (invited)
8. From vision to action in the primate grasping circuit (virtual). Department of Biomedical and Molecular Sciences, Queen's University. January 20th, 2022 (invited)
9. Rapid motor responses reflect explicit sensory priors (blitz talk, virtual). 31st Neural Control of

Movement Conference. April 20th, 2021(invited)

10. Combining deep learning a primate electrophysiology to understand reach and grasp control (virtual). Quantitative Life Sciences Seminar Series, McGill University. April 6th, 2021 (invited)
11. Combining deep learning a primate electrophysiology to understand reach and grasp control (virtual). Université de Montréal. February 23rd, 2021 (invited)
12. Combining deep learning a primate electrophysiology to understand reach and grasp control (virtual). Facebook AI – Brain & AI Meeting. January 27th, 2021 (invited)
13. Combining deep learning a primate electrophysiology to understand reach and grasp control (virtual). Behavioural Neuroscience and Neuroprosthetics Lab Journal Club. November 27th, 2020 (invited)
14. Combining deep learning a primate electrophysiology to understand reach and grasp control (virtual). Simons-Emory International Consortium on Motor Control Meeting. October 8th, 2020 (invited)
15. Combining deep learning a primate electrophysiology to understand reach and grasp control (virtual). Barcelona Computational, Cognitive and Systems Neuroscience Community Webinar. July 1st, 2020 (invited)
16. A goal-driven modular neural network predicts parieto-frontal neural dynamics during grasping (short talk, virtual). Neuromatch 2.0. May 27th, 2020 (invited)
17. A modular neural network model of grasp movement generation (workshop talk). COSYNE 2020. Breckenridge, CO, March 3rd, 2020 (invited)
18. 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 (invited)
19. WHAT'S IN THE BOX? - Interpretable neural nets for movement control (Workshop talk). COSYNE 2018. Breckenridge, CO, USA. March 6th, 2018 (invited)
20. Performance-driven recurrent neural networks for complex motor control (Workshop talk). COSYNE 2018. Breckenridge, CO, USA. March 5th, 2018 (invited)
21. Performance-driven recurrent neural networks for complex motor control. Numenta. Redwood City, CA, USA. November 29th, 2017 (invited)
22. A modular neural network model of the primate grasping circuit (nanosymposium). Annual Meeting of the Society for Neuroscience. Washington, DC, USA. November 14th, 2017 (invited)
23. 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 (invited)
24. Continuous decoding of hand grips with a high dimensional brain computer interface (nanosymposium, presented in place of Andres Agudelo-Toro). Annual Meeting of the Society for Neuroscience. San Diego, CA, USA. November 16th, 2016 (invited)
25. 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 (invited) *Travel grant awarded*
26. Probing and modeling the continuum of immediate to withheld grasping movements in the macaque fronto-parietal network. Neural-Prosthetic Systems Laboratory. Stanford, CA, USA. May 24th, 2016 (invited)
27. 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 (invited)
28. Grasping with and without motor preparation (nanosymposium). 45th Annual Meeting of the Society for Neuroscience. Chicago, IL, USA. October 20th, 2015 (invited) *Travel grant awarded*
29. Laterality of grasp-related activity in macaque areas AIP and F5. 8th Primate Neurobiology Meeting.

Göttingen, Germany. March 18th, 2015 (invited)

30. 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 (invited)

News Coverage

- Program brings together scientists and policymakers to improve communication, build relationships (2023). *Schulich School of Medicine and Dentistry News*.
- Göttinger Forscher entwickeln Modell für Neuroprothesen [Scientists in Göttingen develop a model for neuroprosthetics] (2020). *Göttinger Tageblatt.*