

Scott Rich, PhD

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ACADEMIC POSITIONS *Assistant Professor, Department of Physiology and Neurobiology*
University of Connecticut, Storrs, CT January 2024-Present
Affiliate Appointments: Mathematics

EDUCATION *Doctor of Philosophy, Applied and Interdisciplinary Mathematics*
University of Michigan, Ann Arbor, MI April 2018
Graduate Certificate: Computational Discovery and Engineering
Advisors: Dr. Victoria Booth and Dr. Michal Zochowski
Thesis: "Interacting Mechanisms Driving Synchrony in Neural Networks with Inhibitory Interneurons"

Bachelor of Science, Mathematics
Duke University, Durham, NC May 2012
Minors: Chemistry and Philosophy
Graduation Honors: Summa Cum Laude, Phi Beta Kappa

RESEARCH TRAINING Research Fellow
SickKids Research Institute February 2023-December 2023
University of Toronto Toronto, Ontario
PI: Dr. Steven Prescott

Postdoctoral Research Fellow and Valiante Lab Team Leader
Krembil Brain Institute March 2021-January 2023
University Health Network, University of Toronto Toronto, Ontario
Primary PI: Dr. Taufik Valiante
Co-PIs: Dr. Jérémie Lefebvre and Dr. Frances Skinner

Postdoctoral Research Fellow
Krembil Brain Institute June 2018-February 2021
University Health Network, University of Toronto Toronto, Ontario
Primary PI: Dr. Frances Skinner
Co-PIs: Dr. Taufik Valiante and Dr. Jérémie Lefebvre

PUBLICATIONS Homeira Moradi Chameh, Madeleine Falby, Mandana Movahed, Keon Arbabi, **Scott Rich**, Liang Zhang, Jeremie Lefebvre, Shreejoy J. Tripathy, Maurizio De Pitta, and Taufik A. Valiante. "Distinctive biophysical features of human cell-types: insights from studies of neurosurgically resected brain tissue." *Frontiers in Synaptic Neuroscience* 15, 2023. DOI: [10.3389/fnsyn.2023.1240834](https://doi.org/10.3389/fnsyn.2023.1240834)

Happy Inibhunu, Homeira Moradi Chameh, Frances Skinner*, **Scott Rich***, and Taufik A. Valiante*. "Hyperpolarization-activated cation channels shape the spiking frequency preference of human cortical layer 5 pyramidal neurons." *eNeuro* 10.8, 2023. DOI: [10.1523/ENEURO.0215-23.2023](https://doi.org/10.1523/ENEURO.0215-23.2023)

**Equivalent contribution as senior authors.*

Axel Hutt, **Scott Rich**, Taufik A. Valiante, and Jeremie Lefebvre. “Intrinsic neural diversity quenches the dynamic volatility of neural networks.” *The Proceedings of the National Academy of Sciences* 120.28, 2023. DOI: [10.1073/pnas.2218841120](https://doi.org/10.1073/pnas.2218841120)

Scott Rich, Homeira Moradi Chameh, Jeremie Lefebvre, and Taufik A. Valiante. “Loss of neuronal heterogeneity in epileptogenic human tissue impairs network resilience to sudden changes in synchrony.” *Cell Reports* 39.8, 2022.

DOI: [10.1016/j.celrep.2022.110863](https://doi.org/10.1016/j.celrep.2022.110863)

John David Griffiths, Zheng Wang, Syed Hussain Ather, Davide Momi, **Scott Rich**, Andreea Diaconescu, Anthony Randal McIntosh, and Kelly Shen. “Deep learning-based parameter estimation for neurophysiological models of neuroimaging data.” *bioRxiv*, 2022.

Homeira Moradi Chameh, **Scott Rich**, Lihua Wang, Fu-Der Chen, Liang Zhang, Peter L Carlen, Shreejoy Tripathy, and Taufik A. Valiante. “Diversity amongst human cortical pyramidal neurons revealed via their sag currents and frequency preferences.” *Nature Communications* 12.1, 2021. DOI: [10.1038/s41467-021-22741-9](https://doi.org/10.1038/s41467-021-22741-9)

Frances K. Skinner, **Scott Rich**, Anton R. Lunyov, Jeremie Lefebvre, Alexandra P. Chatzikalymniou. “A hypothesis for theta rhythm frequency control in CA1 microcircuits.” *Frontiers in Neural Circuits*, 15, 2021. DOI: [10.3389/fncir.2021.643360](https://doi.org/10.3389/fncir.2021.643360)

Scott Rich, Homeira Moradi Chameh, Vladislav Sekulic, Frances K. Skinner, and Taufik A. Valiante. “Modeling reveals human-rodent differences in h-current kinetics influencing resonance in cortical layer 5 neurons.” *Cerebral Cortex* 31.2, 2021.

DOI: [10.1093/cercor/bhaa261](https://doi.org/10.1093/cercor/bhaa261)

Scott Rich, Andreea O. Diaconescu, John D. Griffiths, and Milad Lankarany. “Ten simple rules for creating a brand-new virtual academic meeting (even amid a pandemic).” *PLOS Computational Biology* 16.12, 2020.

DOI: [10.1371/journal.pcbi.1008485](https://doi.org/10.1371/journal.pcbi.1008485).

Scott Rich, Axel Hutt, Frances K. Skinner, Taufik A. Valiante, and Jeremie Lefebvre. “Neurostimulation stabilizes spiking neural networks by disrupting seizure-like oscillatory transitions.” *Scientific Reports* 10.1, 2020.

DOI: [10.1038/s41598-020-72335-6](https://doi.org/10.1038/s41598-020-72335-6)

Scott Rich, Homeira Moradi Chameh, Marjan Rafiee, Katie Ferguson, Frances K. Skinner, and Taufik A. Valiante. “Inhibitory network bistability explains increased interneuronal activity prior to seizure onset.” *Frontiers in Neural Circuits* 13, 2020.

DOI: [10.3389/fncir.2019.00081](https://doi.org/10.3389/fncir.2019.00081)

Scott Rich, Michal Zochowski and Victoria Booth. “Effects of Neuromodulation on Excitatory-Inhibitory Neural Network Dynamics Depend on Network Connectivity Structure.” *Journal of Nonlinear Science*, 2018.

DOI: [10.1007/s00332-017-9438-6](https://doi.org/10.1007/s00332-017-9438-6)

Scott Rich, Michal Zochowski and Victoria Booth. “Dichotomous dynamics in E-I networks with strongly and weakly intra-connected inhibitory neurons.” *Frontiers in Neural Circuits* 11, 2017. DOI: [10.3389/fncir.2017.00104](https://doi.org/10.3389/fncir.2017.00104)

Scott Rich, Victoria Booth and Michal Zochowski. “Intrinsic cellular properties and connectivity density determine variable clustering patterns in randomly connected inhibitory neural networks.” *Frontiers in Neural Circuits* 10, 2016.

DOI: 10.3389/fncir.2016.00082

FELLOWSHIPS, Fellowships and Funding:

**HONORS &
AWARDS**

- **SickKids “PI Prep School” Finalist:** As a 2023 finalist in this highly competitive program, which included an invitation to in an intensive simulated faculty interview process, I received a **\$10K CAD seed grant as a principal investigator** for the pursuit of preliminary data for my independent research.
- **CIHR Fellowship:** Winner of a postdoctoral fellowship from the Canadian Institutes of Health Research. **\$40K CAD stipend plus \$5K CAD research allowance per year for two years**, beginning April 2023.
- **Savoy Postdoctoral Fellowship:** Winner of a postdoctoral fellowship funded by the Savoy Foundation (Canadian non-profit supporting epilepsy research) in the 2023-24 cycle. **\$35K CAD** as support for one year of postdoctoral research. *NOTE: This fellowship was declined upon receipt of the CIHR Fellowship given the Savoy Foundation’s policies regarding holding multiple awards.*
- **Stériade-Savoy Postdoctoral Fellowship:** Top rated postdoctoral application to the Savoy Foundation (Canadian non-profit supporting epilepsy research) in the 2021-22 cycle. **\$36.5K CAD** as support for one year of postdoctoral research.
- **Yuet Ngor Wong Award:** Inaugural winner of award from the University of Toronto Department of Physiology supporting quantitative research applied to health or disease. **\$10K CAD** award as support for the 2020-21 academic year.
- **Krembil Postdoctoral Fellowship:** Winner of the Fall 2018 Krembil Postdoctoral and Clinical Fellowship Award Competition. **\$30K CAD** award as support for one year of postdoctoral research.

Presentation Honors:

- Excellence in Oral Presentation Award at the University of Toronto’s Collaborative Program In Neuroscience (CPIN) 2022 Research Day.
- First Place Postdoctoral Oral Presentation at Krembil Research Day 2021.
- First Place Postdoctoral Oral Presentation at Krembil Research Day 2019.
- Best Student Poster Award at the 26th Annual Computational Neuroscience Meeting (CNS) in Antwerp, Belgium (July 2017).

Conference Awards:

- Recipient of a June 2019 Office of Research Trainees (ORT) Travel Award (**\$500 CAD**) and a March 2022 ORT Conference Award (**\$420 CAD**) from University Health Network (UHN).
- Selected as a 2021 American Epilepsy Society (AES) Fellow (**\$750 USD, plus conference registration and one year of AES membership**).
NOTE: Due to COVID-19 travel restrictions, I was forced to decline this award.
- Three-time recipient of Organization for Computational Neurosciences (CNS) Travel Award (2015, 2017, 2019, **\$800 USD**).

- Three-time recipient of Rackham Conference Travel Grant from the University of Michigan (2015-2017, **\$800-1050 USD**).

**CONFERENCE/
SPOTLIGHTED
TALKS**

- Krembil Computational Neuroscience Seminar* October 2023
- Invited to present at the Krembil Computational Neuroscience (KCN) seminar.
- Canadian Computational Neuroscience Spotlight v4* October 2023
- Presented the welcome and concluding talks and a tutorial on models of physiological and pathological microcircuit oscillations, alongside chairing multiple sessions and moderating a panel discussion, at the event which I was the lead-organizer of.
- CAN Postdoctoral Seminar Series* July 2023
- Selected to present in the inaugural Canadian Association for Neuroscience (CAN) Postdoctoral Seminar Series.
- CAIMS Meeting* June 2023
- Invited to present at a minisymposium on Computational Neuroscience at the Canadian Applied and Industrial Math Society (CAIMS) Meeting.
- SickKids Postdoctoral Seminar Series* May 2023
- Selected to present at the SickKids Research Training Center’s seminar series.
- University of Connecticut* February 2023
- Invited seminar speaker by the Department of Physiology and Neurobiology at the University of Connecticut.
- University at Buffalo* November 2022
- Invited speaker at the Applied Math Seminar at the University at Buffalo.
- BIRS Workshop* October 2022
- Invited to present at workshop entitled “Recent Progress in Detection and Prediction of Epilepsy” at the Banff International Research Station for Mathematical Innovation and Discovery (BIRS).
- Canadian Computational Neuroscience Spotlight v3* June 2022
- Presented the welcome and concluding talks, chaired multiple sessions, and moderated a panel discussion at the event which I was the lead-organizer of.
- Fifth Northeast Regional Conference on Complex Systems* March 2022
- Invited to speak at the NERCCS 2022 Conference, presenting work entitled “Multistability and bifurcations in epileptogenic neural circuits.”
- American Epilepsy Society Annual Meeting* December 2021
- Invited to speak at the Scientific Symposium on “Computational Approaches to Epilepsy” at the 2021 meeting of the American Epilepsy Society.
- Neuromatch 4.0* December 2021
- Selected to give a live talk entitled “Resilience through diversity: Loss of neuronal heterogeneity in epileptogenic human tissue impairs network resilience to sudden changes in synchrony.”
- 30th Annual Computational Neuroscience Meeting (CNS)* July 2021
- Selected to present work entitled “Lost neural heterogeneity in human epilepsy is a fundamental principle unifying epileptic etiologies” as a featured oral presentation.

- Krembil Research Day* June 2021
- Selected to present work entitled “Lost neural heterogeneity in human epilepsy is a fundamental principle unifying epileptic etiologies” as an oral presentation.
- Canadian Computational Neuroscience Spotlight v2* May 2021
- Presented the welcome and concluding talks, chaired multiple sessions, and moderated a panel discussion at the event which I was the lead-organizer of.
- Canadian Computational Neuroscience Spotlight* June 2020
- Presented the welcome and concluding talks, a tutorial on multi-stability and bifurcations and their applications in computational neuroscience, and moderated two panel discussions at the inaugural event which I was the lead-organizer of.
- Neuromatch 2.0* May 2020
- Presented a short talk entitled “Modeling reveals human-rodent differences in h-channel kinetics influencing resonance in cortical layer 5 neurons.”
- Krembil Seminar Series* January 2020
- Invited to present at the Krembil Research Institute’s institute-wide seminar.
- Krembil Research Day* May 2019
- Selected to present work entitled “Modeling implicates inhibitory network bistability as an underpinning of seizure initiation” as an oral presentation.
- SIAM Conference on the Life Sciences (LS18)* August 2018
- Invited to present work entitled “Intrinsic cellular properties determine variable clustering patterns in randomly connected inhibitory neural networks” at the mini-symposium entitled “Rhythms and Synchronization in Neural Networks.”

LEADERSHIP

- Canadian Computational Neuroscience Spotlight v4* October 2023
- Lead organizer of the upcoming fourth edition of this meeting.
- Canadian Computational Neuroscience Spotlight v3* June 2022
- Lead organizer of the third edition of this virtual meeting. Primary responsibilities included leading a group of co-organizers and session chairs, executing the meeting, and spearheading outreach and advertising.
- Canadian Computational Neuroscience Spotlight v2* May 2021
- Lead organizer of the second edition of this virtual meeting. Responsibilities included inviting session chairs, curating the meeting’s program, creating a permanent website, digital advertising, and leading a group of co-organizers.
- Office of Research Trainees (ORT) Leadership Committee* Feb 2021-Dec 2021
- Member of the trainee leadership committee for the University Health Network (UHN), highlighting issues of importance to graduate students and postdoctoral researchers and planning programs for trainee professional development.
- Canadian Computational Neuroscience Spotlight* June 2020
- Lead organizer of the creation of a new virtual meeting motivated by the conference cancellations due to the COVID-19 pandemic. Responsibilities involved choosing an online platform, inviting speakers, crafting the themes and goals of the meeting, organizing the final schedule, and moderating sessions and panel discussions.

Krembil Computational Neuroscience (KCN) 2020 Symposium June 2020

- Member of the organizing committee of this upcoming two day symposium on the topic of “Math as the new brain microscope”.

NOTE: This symposium was cancelled due to the COVID-19 pandemic.

Neural Networks Interdisciplinary Workshop Fall 2017-Spring 2018

- Co-Student Coordinator of interdisciplinary biweekly workshop. Responsibilities included inviting and scheduling speakers and successfully securing funding via a Rackham Interdisciplinary Workshop grant from the University of Michigan.

Student Quantitative Biology Seminar Fall 2016-Winter 2017

- Organized inaugural edition of seminar to give graduate students a forum to present their research and topics of interest to other interested students.

Society for Industrial and Applied Math Student Chapter Fall 2012-Spring 2013

- Served as treasurer and helped organize the yearly SIAM Student Conference.

TEACHING & MENTORING

Undergraduate Student Mentoring Spring 2021-Present

- Designed a project and recruited a student for summer 2021 undergraduate research that received NSERC USRA funding. Grew this project to include an additional student in the Fall of 2021, and supervised both undergraduates on continued work on this research into the present.
- Conceived, designed, and implemented the “Neuron to Brain Lab Computational Neuroscience Reading Group” in Summer 2021 to expose undergraduate students to computational neuroscience despite COVID-19 limitations.
- Designed computational research projects for students recruited from this reading group; including the project started via the NSERC USRA program, I have continuously supervised three projects with four total students since 2021.

Graduate Student Mentoring Summer 2019-Present

- Directly mentored a “work study” Master’s student on a summer project under the supervision of Drs. Taufik Valiante and Jeremie Lefebvre in Summer 2022.
- Led the recruitment of a new computational Master’s student to the Valiante Lab in the Spring of 2022. Responsibilities included crafting the proposed project, advertising the opportunity, screening applications, and interviewing top candidates. Supervised this student’s transition into the lab throughout the summer.
- Mentored a Master’s student under the supervision of Dr. Jérémie Lefebvre beginning in Winter 2021 and continuing to their graduation in Fall 2022.
- Advised a PhD student in the lab of Dr. Taufik Valiante pursuing a computational project from Fall 2020 to Winter 2022.
- Co-mentored, with Dr. Frances Skinner, a medical student on a research project beginning in 2019 and continuing through the project’s completion in 2023.

M-Engin Summer Transition Program Summer 2015-Summer 2016

University of Michigan, Ann Arbor, MI

- Mathematics Instructor for 6 week summer college preparatory program for incoming engineering undergraduates from under-represented populations and disadvantaged educational backgrounds.
- Developed and taught course designed to simulate a second-semester Introductory Calculus course as taught at the level expected at the University of Michigan.

Graduate Student Instructor
University of Michigan, Ann Arbor, MI

Fall 2012-Fall 2014

- Taught one semester of Math 115 and four semesters of Math 116 (first and second-semester Introductory Calculus courses, respectively).
- Gave lectures, wrote and graded quizzes, and graded homework for an individual section of the course. Also proctored and graded course-wide examinations.

**SCHOLARLY
REVIEWS**

Canadian Institutes of Health Research (CIHR)

- Reviewed applications to the 2023-24 Doctoral Research Award competition.

PLoS Computational Biology

- Provided a review of a manuscript submitted in Fall 2023.
- Provided a review of a manuscript submitted in Summer 2020.

The Proceedings of the National Academy of Sciences

- Provided a review of a manuscript submitted in Summer 2023.

CNS Meeting

- Provided multiple reviews for the 2019, 2020, 2022, and 2023 Meetings.

Scientific Reports

- Provided a review of a manuscript submitted in Winter 2023.

NeuroImage

- Provided a review of a manuscript submitted in Summer 2022.
- Provided a review of a manuscript submitted in Spring 2022.

Communications Biology

- Provided a review of a manuscript submitted in Summer 2022.

Cerebral Cortex

- Assisted Dr. Taufik Valiante in reviewing a manuscript submitted in Winter 2022.

Cognitive Neurodynamics

- Provided a review of a manuscript submitted in Winter 2022.
- Provided a review of a manuscript submitted in Fall 2021.

Journal of Computational Neuroscience

- Provided a review of a manuscript submitted in Winter 2022.
- Provided a review of a manuscript submitted in Winter 2021.

eNeuro

- Provided a review of a manuscript submitted in Winter 2022.

Frontiers in Bioscience-Landmark

- Provided a review of a manuscript submitted in Fall 2021.

BMC Neuroscience

- Provided a review of a manuscript submitted in Spring 2021.
- Provided a review of a manuscript submitted in Summer 2018.

Frontiers in Cellular Neuroscience

- Assisted Dr. Taufik Valiante in reviewing a manuscript submitted in Spring 2021.

eLife

- Provided a review of a manuscript submitted in Spring 2019.

- Provided a review of a manuscript submitted in Spring 2018.

**PUBLISHED
POSTER
ABSTRACTS**

S. Rich and S.A. Prescott. “Disruptions to gamma oscillations caused by depolarizing shifts in the GABA reversal potential are mitigated by noise”. 2023 Annual Meeting of the Society for Neuroscience, 577.03, 2023.

S. Rich, H Moradi Chameh, T.A. Valiante, J. Lefebvre. “A neural network model of stochastic seizure-like activity driven by input correlations.” Krembil Research Day, 2022.

S. Rich, H Moradi Chameh, T.A. Valiante, J. Lefebvre. “A neural network model of stochastic seizure-like activity driven by input correlations.” CPIN (Collaborative Program in Neuroscience, University of Toronto) Research Day, 2022.

S. Rich, H Moradi Chameh, T.A. Valiante, J. Lefebvre. “A noise-driven spiking neural network model exhibiting seizure-like dynamics yields insights into the roles of neural heterogeneity, correlated input, and channelopathies in seizure onset.” Canadian Association for Neuroscience Meeting, P3-C-75, 2022.

S. Rich, H Moradi Chameh, J. Lefebvre, T.A. Valiante. “Lost neural heterogeneity in human epilepsy is a fundamental principle unifying epileptic etiologies.” Canadian Association for Neuroscience Meeting, 1-C-75, 2021.

S. Rich, H.M. Chameh, V. Sekulic, T.A. Valiante, and F.K. Skinner. “Modeling reveals human-rodent differences in h-current kinetics influencing resonance in cortical layer 5 neurons.” Krembil Research Day, 2020.

S. Rich, A. Hutt, F.K. Skinner, T.A. Valiante, and J. Lefebvre. “Neurostimulation stabilizes spiking neural networks by disrupting seizure-like oscillatory transitions”. BMC Neuroscience 21 (Suppl 1):54 (P204), 2020.

S. Rich, H.M. Chameh, V. Sekulic, F.K. Skinner, and T.A. Valiante. “Development of a multi-compartment model of a human L5 pyramidal neuron suggests inter-species h-channel kinetic differences”. 49th Annual Meeting of the Society for Neuroscience, 123.25, 2019.

S. Rich, H.M. Chameh, M. Rafiee, K. Ferguson, F.K. Skinner, and T.A. Valiante. “Modeling implicates inhibitory network bistability as an underpinning of seizure initiation”. BMC Neuroscience 20 (Suppl 1):56 (P319), 2019.

S. Rich, H.M. Chameh, M. Rafiee, K. Ferguson, F.K. Skinner, and T.A. Valiante. “Bistability as an underpinning of seizure initiation in simulated inhibitory networks”. Canadian Association for Neuroscience Meeting, 2-C-77, 2019.

S. Rich, V. Booth and M. Zochowski. “Heterogeneous inter- and intra-connectivity within E-I networks influences the effects of cholinergic modulation on synchronous oscillatory behavior of excitatory cells”. 47th Annual Meeting of the Society for Neuroscience, 92.10, 2017.

S. Rich, V. Booth and M. Zochowski. “Cellular and network properties of interneuron networks dictate variable clustering patterns in both strictly inhibitory and E-I neural networks”. BMC Neuroscience 18(Suppl 1): P304, 2017.

S. Rich, V. Booth and M. Zochowski. “Bursting properties of interneuron networks are affected by cholinergic modulation of intrinsic cellular properties”. 46th Annual Meeting of the Society for Neuroscience, 506.23, 2016.

S. Rich, V. Booth and M. Zochowski. “The role of cellular membrane properties in generating synchronous activity in inhibitory networks”. 45th Annual Meeting of the Society for Neuroscience, 94.01, 2015.

S. Rich, V. Booth and M. Zochowski. “The role of adaptation current in synchronously firing inhibitory neural networks with various topologies”. BMC Neuroscience 16(Suppl 1): P303, 2015.

SCICOMM WRITING

Times Higher Education

- Published opinion piece as part of a series, “Are true friendships possible in academia?”, on April 27, 2023.
- Published opinion piece, entitled “The ‘virtual academy’ must not leave the next generation behind”, on July 14, 2020.
- Published opinion piece, entitled “Tweet this: There is more to academic life than triumph and misery”, on December 4, 2019.

Office of Research Trainees (ORT) Times

- Worked as Science Writer from April 2020-March 2021 for the newsletter focusing on trainee issues for the University Health Network (UHN) community.

VOLUNTEER ACTIVITIES

Quantum Sports Learning Association Winter 2019-Spring 2020 (COVID)

- Volunteer as both as basketball coach and math instructor for the QSLA “Ball-matics” program, which aims to promote confidence and interest in mathematics for educationally-disadvantaged youth by combining math lessons with basketball.

Duke University Alumni Admissions Advisory Committee Winter 2014-Present

- Volunteer interviewer for applicants to Duke University, providing an assessment of approximately three such applicants per admissions cycle.

SOCIETY MEMBERSHIPS

- Trainee member of the American Epilepsy Society (2021-2022).
- Postdoctoral member of the Society for Neuroscience (2019-2023). Previously a student member (2015-2017).
- Postdoctoral member of the Canadian Association for Neuroscience (2019-2023).
- Postdoctoral member of the Organization for Computational Neuroscience (2019-2023). Previously a student member (2015-2017).