Scott Rich

Toronto, ON
E-mail: sbrich (at) umich (dot) edu

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, Spring 2012
Minors: Chemistry and Philosophy
Graduation Honors: Summa Cum Laude, Phi Beta Kappa

RESEARCH POSITIONS

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

- Leader of the new "Computational Pillar" of the Valiante Lab
- Responsibilities include recruiting and supervising computational trainees, generating new collaborative projects, and applying for grants
- Direct collaboration with electrophysiologists to analyze data, propose experiments, and test hypotheses generated via computational exploration

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

- Primary liason between three interdisciplinary supervisors
- Utilized human data to create single neuron and neural network models
- Applied computational and mathematical tools to study seizure onset

FELLOWSHIPS, HONORS & AWARDS

Fellowships and Funding:

- **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 quantiative 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:

- 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).

Travel Awards:

- Recipient of a June 2019 Office of Research Trainees (ORT) Travel Award from University Health Network (UHN) (**$500 CAD**).
- 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**).

PUBLICATIONS

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**

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**

Scott Rich, Homeira Moradi Chameh, Jeremie Lefebvre, and Taufik A. Valiante. "Resilience through diversity: loss of neuronal heterogeneity in epileptogenic human tissue renders neural networks more susceptible to sudden changes in synchrony." *bioRxiv*, 2021 (in revision, *PNAS*).

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

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.

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

Alexandra P. Chatzikalymniou, Melisa Gumus, Anton R. Lunyov, **Scott Rich**, Jeremie Lefebvre, and Frances K. Skinner. "Linking minimal and detailed models of CA1 microcircuits reveals how theta rhythms emerge and how their frequencies are controlled." *bioRxiv*, 2020.

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**

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**

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**

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**

CONFERENCE TALKS

American Epilepsy Society Annual Meeting December 2021

- Invited to speak at a Scientific Symposium on "Computational Approaches to Epilepsy" at the upcoming 2021 meeting of the American Epilepsy Society.

30th Annual Computational Neuroscience Meeting (CNS) July 2021

- Presented 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

- Presented work entitled "Lost neural heterogeneity in human epilepsy is a fundamental principle unifying epileptic etiologies."

Canadian Computational Neuroscience Spotlight v2 May 2021

- Presented the welcome and concluding talks 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 Research Day May 2019

- Presented work entitled "Modeling implicates inhibitory network bistability as an underpinning of seizure initiation."

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 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-Present

- 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 has been delayed 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

- Recruited a student under the computational pillar of the Valiante Lab for a summer undergraduate research project that received NSERC USRA funding.
- Conceived, designed, and implemented the "Neuron to Brain Lab Computational Neuroscience Reading Group" to expose undergraduate students to computational neuroscience despite COVID-19 limitations and initiate future recruitment efforts.

Graduate Student Mentoring Summer 2019-Present

- Serving as the direct mentor for a master's student under the supervision of Dr. Jérémie Lefebvre beginning in Winter 2021 and continuing into the present.
- Advising a PhD student in the lab of Dr. Taufik Valiante pursuing a computational project beginning in Fall 2020 and continuing into the present.
- Working with Dr. Frances Skinner to mentor a medical student on a research project beginning in Summer 2019 and continuing into the present.

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 Fall 2012-Fall 2014
University of Michigan, Ann Arbor, MI

- 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

BMC Neuroscience

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

Journal of Computational Neuroscience

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

PLoS Computational Biology

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

CNS Meeting

- Provided multiple reviews of abstract submissions under consideration for travel awards and oral presentations for the 2019 and 2020 Meetings.

eLife

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

Journal of Integrative Neuroscience

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

PUBLISHED ABSTRACTS

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, A. Hutt, F.K. Skinner, T.A. Valiante, and J. Lefebvre. "Neurostimulation stabilizes spiking neural networks by disrupting seizure-like oscillatory transitions". 29th Annual Computational Neuroscience Meeting, 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): 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

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.

Times Higher Education

- 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.

VOLUNTEER ACTIVITIES

Quantum Sports Learning Association Winter 2019-Present

- Volunteer as both as basketball coach and math instructor for the QSLA "Ballmatics" 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

- Postdoctoral member of the Society for Neuroscience (2019-present).
- Postdoctoral member of the Canadian Association for Neuroscience (2019-present).
- Postdoctoral member of the Organization for Computational Neuroscience (2019-present).