

Laura Medlock, MSc

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EDUCATION

2020/01 – Present	Doctor of Philosophy, Biomedical Engineering University of Toronto, Toronto, Ontario, Canada	Supervisor: <u>Dr. Steve Prescott</u>
2016/09 – 2018/08	Master of Science, Neuroscience (thesis link) Queen's University, Kingston, Ontario, Canada	Supervisor: <u>Dr. Alastair Ferguson</u>
2012/09 – 2016/04	Bachelor of Science Honours, Life Sciences & Mathematics Queen's University, Kingston, Ontario, Canada	

SCHOLARSHIPS & GRANTS

2022/05 – Present	CIHR Doctoral Graduate Scholarship (CGS-D) Canadian Institutes of Health Research (CIHR), Canada – Competitive	\$105,000
2020/09 – 2022/04	Research Training Competition (Restrcomp) Graduate Scholarship The Hospital for Sick Children, Canada – Competitive	\$104,000
2020/01	University of Toronto Fellowship , University of Toronto, Canada	\$10,000
2016/09 & 2017/09	Queen's Graduate Award , Queen's University, Canada	\$6,000 + \$7,000
2012/09	Queen's University Excellence Scholarship , Queen's University, Canada	\$2,000

SCIENTIFIC PUBLICATIONS ([link](#))

Medlock L, Al-Basha D, Halawa A, Dedek C, Ratté S, Prescott SA. Encoding of vibrotactile stimuli by mechanoreceptors in rodent glabrous skin (2024). *bioRxiv*. <https://doi.org/10.1101/2024.01.29.577766>

Gradwell MA, Ozeri-Engelhard N, Eisdorfer JT, Laflamme OD, Gonzalez M, Upadhyay A, **Medlock L**, [16 authors], Prescott SA, Akay T, Abaira VE (2024). Multimodal sensory control of motor performance by glycinergic interneurons of the spinal cord deep dorsal horn. *Neuron*, *in press*. <https://doi.org/10.1101/2022.05.21.492933>

Sagalajev B, Zhang T, Abdollahi N, Yousefpour N, **Medlock L**, Al-Basha D, Ribeiro-da-Silva A, Esteller R, Ratté S, Prescott SA. (2023). Absence of paresthesia during high-rate spinal cord stimulation reveals importance of synchrony for sensations evoked by electrical stimulation. *Neuron* 120: 1-17. <https://doi.org/10.1016/j.neuron.2023.10.021>

Medlock L, Sekiguchi K, Hong S, Dura-Bernal S, Lytton WW, Prescott SA. (2022). Multiscale computer model of the spinal dorsal horn reveals changes in network processing associated with chronic pain. *The Journal of Neuroscience* 42(15): 3133-3149. <https://doi.org/10.1523/JNEUROSCI.1199-21.2022>

Medlock L, Shute L, Fry M, Standage D, Ferguson A. (2018). Ionic mechanisms underlying tonic and burst firing behavior in subfornical organ neurons: a combined experimental and modeling study. *Journal of Neurophysiology* 120(5): 2269-2281. <https://doi.org/10.1152/jn.00340.2018>

EDUCATION RESEARCH PUBLICATIONS

Medlock L, Robb KP, Hameed S, Banh J, Kilkenny DM. Development of a support program to enhance the experience of undergraduate engineering summer research students. *2024 Canadian Engineering Education Association (CEEA)*.

AREAS OF RESEARCH & SKILLS

Computational Neuroscience, Biomedical Engineering, Neuroscience, Mathematics, Network Models, Pain, Neural Coding, Somatosensation, Neuron Models, Statistics, Data Analysis, MATLAB, Python, Jupyter Notebook, R Studio, Google Cloud Platform, Visual Studio Code, Spyder, Bash, Git, GitHub, Machine Learning, Clustering, Classification, Support Vector Machines, High Performance Computing (HPC), PBS/Torque, Slurm, Open MPI, Evolutionary Algorithms, NEURON, NetPyNE, NumPy, Pandas, SciPy, Scikit-Learn, Matplotlib, Seaborn, XPP/AUTO, Illustrator, Photoshop, HTML/CSS.

RESEARCH EXPERIENCE

Ph.D. Candidate, Computational Neuroscience

Institute of Biomedical Engineering, University of Toronto, Toronto ON Canada

Neurosciences & Mental Health, The Hospital for Sick Children, Toronto ON Canada

2020/01 – Present

- My research uses computational modeling techniques to examine touch and pain processing in the spinal cord.
- To investigate this topic, I use single neuron and network modeling, advanced data analytics, and machine learning techniques.
- I've published various open-source models of the spinal cord to aid basic research and clinical investigation into pain therapeutics.

Master's Graduate Research Fellow

Center for Neuroscience Studies, Queen's University, Kingston ON Canada

2016/09 – 2018/08

- Developed and published a computational model of subfornical organ (SFO) neurons to investigate energy homeostasis.
- Analyzed experimental data, developed computational neuron models, and drafted a manuscript for publication.
- Gained expertise in MATLAB and Python, as well as data science techniques, including machine learning and statistical analysis.

Undergraduate Research Assistant

Faculty of Health Sciences, Queen's University, Kingston ON Canada

2015/05 – 2016/08

- Collected and analyzed electrophysiology data from experiments performed on sensory neurons in the hypothalamus.
- Hands-on experience with different experimental techniques including *in vivo/in vitro* patch-clamp and multielectrode recordings from individual neurons.
- This position gave me the opportunity to practice collaborative research techniques, to strengthen my attention to detail, and to critically analyze and interpret scientific findings.

CONFERENCE PRESENTATIONS & SEMINARS

- 2023/11 **Medlock L.** and Prescott SA. Disinhibition compromises spatiotemporal processing of tactile input by disrupting the receptive fields of spinal dorsal horn neurons.
Society for Neuroscience Conference (Neuroscience 2023), Washington, DC, United States. Poster Presentation.
- 2023/11 Halawa A., **Medlock L.**, Al-Basha D., Dedek C., Ratté S., Prescott SA. Adaptation in low-threshold mechanoreceptors improves encoding of stimulus amplitude and frequency.
Society for Neuroscience Conference (Neuroscience 2023), Washington, DC, United States. Poster Presentation.
- 2023/10 **Medlock L.** and Prescott SA. Encoding of vibrotactile stimuli by mechanoreceptors in rodent glabrous skin.
3rd Annual Canadian Computational Neuroscience Spotlight (CCNSv4 2023), Toronto, Canada.
- 2023/05 **Medlock L.**, Al-Basha D., Dedek C., Ratté S., Prescott SA. Encoding of vibrotactile stimuli by mechanoreceptors in rodent glabrous skin.
16th Annual Canadian Association for Neuroscience (CAN 2023), Toronto, Canada. Poster Presentation
- 2023/05 **Medlock L.**, and Prescott SA. Encoding of vibrotactile stimuli by mechanoreceptors in rodent glabrous skin.
Toronto Biomedical Engineering Conference (ToBE 2023), Toronto, Canada. Poster Presentation
- 2022/11 **Medlock L.**, Al-Basha D., Dedek C., Ratté S., Prescott SA. Encoding of vibrotactile stimuli by mechanoreceptors in rodent glabrous skin.
Society for Neuroscience Conference (Neuroscience 2022), San Diego, California, United States. Poster Presentation.
- 2022/09 **Medlock L.** Multiscale computer model of the spinal dorsal horn.
IASP 2022 World Congress on Pain (IASP 2022), Toronto, Canada. Poster Presentation.
- 2022/06 **Medlock L.** Multiscale model of the spinal dorsal horn reveals changes in network processing associated with chronic pain.
3rd Annual Canadian Computational Neuroscience Spotlight (CCNSv3 2022), Toronto, Canada. Awarded – Spotlight Trainee Seminar.
- 2022/05 **Medlock L.**, Sekiguchi K., Dura-Bernal S., Lytton WW., Prescott SA. Multiscale model of the spinal dorsal horn reveals changes in network processing associated with chronic pain.
15th Annual Canadian Association for Neuroscience (CAN 2022), Toronto, Canada. Poster Presentation.
- 2021/08 **Medlock L.**, Al-Basha D., Dedek C., Ratté S., Prescott SA. The role of synchronous spiking in the encoding of vibrotactile stimuli by low-threshold mechanoreceptors.
14th Annual Canadian Association for Neuroscience (CAN 2021), Vancouver, Canada. Poster Presentation.
- 2021/06 **Medlock L.**, Sekiguchi K., Dura-Bernal S., Lytton WW., Prescott SA. Multiscale model of the spinal dorsal horn reveals changes in network processing associated with chronic pain.
Collaborative Program in Neuroscience (CPIN) Research Day, Toronto, Canada. Seminar.
- 2018/05 **Medlock L.**, Simpson N., Standage D., Ferguson A. V. Conductance-based model of subfornical organ neurons predicts integration of cardiovascular and inflammatory signals.
12th Annual Canadian Association for Neuroscience (CAN 2018), Vancouver, Canada. Poster Presentation.

- 2017/11 **Medlock L.**, Shute L., Fry M., Standage D., Ferguson A. V. A Hodgkin-Huxley type model of subfornical organ neurons. *Society for Neuroscience Conference (Neuroscience 2017), Washington, DC, United States. Poster Presentation.*
- 2017/06 **Medlock L.**, Shute L., Fry M., Standage D., Ferguson A. V. A novel computational model underlying the spiking dynamics of a subfornical organ neuron. *11th Annual Canadian Association for Neuroscience (CAN 2017), Montreal, Canada. Poster Presentation.*

RELEVANT TRAINING & WORKSHOPS

Krembil Computational Neuroscience Summer Academy

Krembil Centre for Neuroinformatics, Center for Addiction and Mental Health (CAMH), Toronto, ON, Canada

2023/07

- Five-day intensive, project-based course where we learned hands-on techniques for integrating multi-scale neuroscience data.
- Member of the Single Cell Transcriptomics Project, mentored by Dr. Shreejoy Tripathy, where we learned integrative analysis of human single-nucleus gene expression data from the Allen Brain Atlas database.

NetPyNE & NEURON 2021 Workshop

SUNY Downstate Health Sciences University, Brooklyn, NY, USA

2021/05

- Course designed to introduce NEURON and NetPyNE for constructing, simulating, and analyzing network models in Python.
- Hands-on experience collaborating with peers to develop multiscale models of the spinal cord. **Project awarded 1st place prize.**

TEACHING EXPERIENCE

Co-Instructor, Undergraduate Summer Research Program (USRP)

Faculty of Applied Science & Engineering, University of Toronto

2023/05 – Present

- Co-instructor alongside Dawn Kilkenny, Vice-Dean, First Year, running the USRP program at the University of Toronto.
- My role involves preparing and leading professional development seminars, developing and implementing curriculum, outreach to faculty and professionals, undergraduate supervision, and weekly planning sessions with the Program Director.
- Hands-on, personalized mentorship of undergraduate summer research students across diverse Engineering departments.

Teaching Assistant, Neural Bioelectricity (BME 445)

Biomedical Engineering, Faculty of Applied Science & Engineering, University of Toronto

2023/09 – 2023/12

- Teaching assistant for a fourth-year undergraduate neuroscience course at University of Toronto.
- My role involves preparing and leading labs, 1-on-1 mentorship of undergraduate students, and designing/marketing exams.

Prospective Professors in Training Program (PPIT)

Engineering Graduate Studies, Faculty of Applied Science & Engineering, University of Toronto

2022/09 – 2023/06

- Recent graduate of the PPIT program through the Graduate Engineering Department at the University of Toronto.
- Gained hands on experience developing curriculum, designing teaching materials, and learning to support students in the context of undergraduate engineering education.

Teaching Assistant, Systems Neuroscience (NSCI 324)

Department of Biomedical & Molecular Sciences, Queen's University

2017/01 – 2018/04

- Two (2) years as the teaching assistant for a third year undergraduate Systems Neuroscience course at Queen's University.
- My role involved preparing and leading tutorials, 1-on-1 mentorship of undergraduate students, marking and administering exams, and presenting lectures on course material.

MENTORSHIP EXPERIENCE

Supervisor & Mentor, Graduate Students, University of Toronto

2020/01 – Present

- One-on-one mentoring/supervising of a Master's student in the Prescott Lab to advise on their thesis project.
- Collaborating with and mentoring three additional incoming Ph.D. students in the Prescott Lab.

Mentor, Undergraduate Students, Queen's University

2016/01 – 2018/08

- Mentored incoming neuroscience Master's and undergraduate students by helping them navigate the program, introducing them to available academic resources, and promoting strong scientific practices.

LEADERSHIP & SERVICE EXPERIENCE

Marketing Director, GECoS Mental Wellness Commission

Graduate Engineering Council of Students (GECoS), University of Toronto

2020/09 – 2023/01

- Led the social media/digital marketing team for GECoS Mental Wellness Commission at the University of Toronto.
- Focused on improving awareness and accessibility of mental health resources for engineering graduate students.

Design Team Executive, NeuGeneration Conference

Queen's University

2017/09 – 2018/02

- Recruited to design, create, and publish digital marketing content (ie. social media, graphics, ads) for NeuGeneration 2018.
- Conference aims to celebrate young investigators and promote research in the field of neuroscience & psychology.

Brain Day Activity Coordinator, Neuroscience Outreach Program

Center for Neuroscience Studies, Queen's University

2015/01 – 2018/08

- Our program focused on educating Grade 5 students from local elementary schools about the importance of brain health & safety, as well as introducing them to neuroscience research.

President, Life Sciences Student Council

Life Sciences & Biochemistry, Faculty of Health Sciences, Queen's University

2015/03 – 2016/04

- Elected to represent the Life Sciences student body (>600 students) as President of Life Sciences Student Council.
- My responsibilities comprised hiring and supervising 20 other council executives, as well as designing new professional development programs for students including the Life Sciences & Biochemistry Career Conference at Queen's University.

Third Year Ambassador, Life Sciences Student Council

Life Sciences & Biochemistry, Faculty of Health Sciences, Queen's University

2014/05 – 2015/05

- Elected to represent the Class of 2016 on student council and to organize educational events in the Queen's Life Sciences community.
- Event planning involved collaboration with faculty and the student body, including development of a new networking event for undergraduate students to network with returning Queen's Alumni.

AWARDS & HONOURS

2024/12	CEEA Student Scholarship Grant (\$1000) , Canadian Engineering Education Association, Canada
2022/11	SGS Conference Grant (\$500) , University of Toronto, Canada
2021/06	IBRO Conference Award (\$100) , Canadian Association for Neuroscience (CAN), Canada
2021/06	NEURON & NetPyNE Project Award (\$100) , Neurosim Lab at SUNY Downstate, USA
2018/05	CAN 2018 Travel Award (\$750) , Canadian Association for Neuroscience (CAN), Canada
2016/04	Dean's Honour List, Faculty of Arts & Science , Fourth Year, Queen's University, Canada
2015/04	Dean's Honour List, Faculty of Arts & Science , Third Year, Queen's University, Canada

INVITED TALKS

2023/10	Topics in Translational Medicine (HMB402), Seminar – Computational Medicine <i>Faculty of Arts & Sciences, University of Toronto. Invited Lecturer.</i>
2023/07	Undergraduate Summer Research Program (USRP) – Graduate Student Panel <i>Faculty of Applied Science & Engineering, University of Toronto. Invited Panelist.</i>
2021/02 & 2022/02	BME Graduate Research Day – Graduate Student Panel <i>Institute of Biomedical Engineering, University of Toronto. Invited Panelist.</i>
2019/09	Women In Tech – An Evening in Digital <i>STA Technological Education. Invited Panelist.</i>