Jennifer Crodelle, PhD

Current position:	**Assistant Professor of Mathematics** at Middlebury College
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Research Interests

Neuronal networks	I am interested in understanding the dynamics of neuronal networks during development and diseased states such as epilepsy.
Pain processing	I work to uncover mechanisms underlying pain processing in the spinal cord using mathematical modeling.

Appointments

2017-2020	NSF Mathematical Sciences Postdoctoral Research Fellow (MSPRF), Courant Institute, NYU
2013-2015	Graduate Assistance in Areas of National Need (GAANN) Research Assistant, Rensselaer Polytechnic Institute

Education

Aug 2017	PhD in Mathematics, **Rensselaer Polytechnic Institute** Thesis: *The role of electrotonic coupling between pyramidal cells in the cortex* Advisor: Prof. Gregor Kovacic
May 2012	BS in Applied Mathematics, **Marist College**

Publications

15. A.G. Ginsberg, F.S. Lempka, B. Duan, V. Booth, **J. Crodelle**. *Mechanisms for dysregulation of excitatory-inhibitory balance underlying allodynia in dorsal horn neural subcircuits.* PLoS Computational Biology 21(1): e1012234. (2025)

14. X. Du, **J. Crodelle**, V. J. Barranca, S. Li, Y. Shi, et al. *Biophysical modeling and experimental analysis of the dynamics of C. elegans body-wall muscle cells.* PLoS Computational Biology 21(1): e1012318. (2025)

13. **J. Crodelle**, C. Vanty*, and V. Booth. *Modeling homeostatic and circadian modulation of human pain sensitivity*, Frontiers in Neuroscience 17, 1166203 (2023).

12. J. M. Epstein, E. Hatna, **J. Crodelle**. *Triple contagion: a two-fears epidemic model* J. Royal Society Interface.18(181):20210186 (2021).

11. **J. Crodelle** and D. W. McLaughlin. *Modeling the role of gap junctions between excitatory neurons in the developing visual cortex.* PLoS Computational Biology, 17(7):e1007915 (2021).

10. **J. Crodelle**, C. Vallejo, M. Schmidtchen, C. Topaz, and M.R. D'Orsogna . *Impacts of California Proposition 47 on crime trends in Santa Monica, CA*, PLoS One, 16(5):e0251199 (2021).

9. **J. Crodelle** and P. Maia. *A Computational model for pain processing in the dorsal horn following axonal damage to receptor fibers*, Brain Sciences, 11(4):505 (2021).

8. **J. Crodelle**, D. Zhou, G. Kovacic, and D. Cai. *A computational model of electrotonic coupling between pyramidal cells in the cortex*, Journal of Computational Neuroscience, 48(4):387–407, (2020).

* *indicates undergraduate student co-authors.*

7. Zq.K. Tian, **J. Crodelle**, and D. Zhou. *A Combined Offline-Online Algorithm for Hodgkin-Huxley Neuronal Networks*. Journal of Scientific Computing, 84(1):10 (2020)

6. **J. Crodelle**, K.A. Newhall, P.B. Pyzza, and G. Kovacic. *Coarse-grained descriptions of oscillations in neuronal network models*. Communications in Mathematical Sciences, 1437:1458, (2019).

5. **J. Crodelle**, M. Hagenauer, S. Piltz, and V. Booth. *Modeling the daily rhythm of human pain processing in the dorsal horn*. PLoS Computational Biology, 15(7): e1007106, (2019).

4. **J. Crodelle**, D. Zhou, G. Kovacic, D. Cai. *A role for electrotonic coupling between cortical pyramidal cells*, Frontiers in Computational Neuroscience, 13:33, (2019).

3. Z.Q. Xu, **J. Crodelle**, D. Zhou, D. Cai. *Maximum entropy principle analysis in network systems with short-time recordings*, Physical Review E, 99:022409, (2019).

2. **J. Crodelle**, M. Hagenauer, S. Piltz, and V. Booth. *A neural circuit model for pain processing in the spinal cord*. Proceedings of A Research Collaboration Workshop for Women in Mathematical Biology, Springer, (2016).

1. M.Hagenauer, **J. Crodelle**, S. Piltz, N. Toporikova, P. Ferguson, and V. Booth. *The Modulation of Pain by Circadian and Sleep-Dependent Processes: A Review of the Experimental Evidence*. Proceedings of A Research Collaboration Workshop for Women in Mathematical Biology, Springer, (2016).

Journal Articles in progress

J. Crodelle and W. Dai. *Activity-dependent effect of cholinergic waves on LGN to V1 synapse formation*

A. Byrne, and **J. Crodelle**. *Mathematical approach to understanding gap junctions and seizure-induced activity.*

Grant funding

2025	*NIH R15 HEAL Initiative (submitted)*, $375,000.
2023 - 2025	*Vermont Biomedical Research Network Project Award*, $150,000.
2022 - 2023	*Vermont Biomedical Research Network Pilot Award*, $25,000 .

Teaching Experience

Middlebury College:

S24	Numerical Analysis (MATH 0228)
S24, F21, S21, F20	Differential Equations (MATH 0226)
S22	Partial Differential Equations (MATH 0326)
Winter 22	Data Science Across Disciplines (NSCI/MATH 1230)
F22, S22, F21	Calculus II (MATH 0122)
F22, S21	Mathematical Modeling (MATH 0315)
F20	Multivariable Calculus (MATH 0223)

Courant Institute:

S20, F19, S19	Linear Algebra (MATH 140)
F18	Ordinary Differential Equations (MATH 262)

Invited Seminars

Dec 2024	*Modeling the effect of spontaneous retinal waves on the development of receptive fields of neurons in primary visual cortex.* Applied Mathematics Seminar, Courant Institute, NY
Oct 2024	*A Modeling approach to studying the effect of retinal waves and on the development of receptive fields of neurons in primary visual cortex.* Mathematical Biology Seminar, Brandeis University (Virtual)
Oct 2024	*Mathematical modeling of neuronal networks and their functional roles,* Mathematics Seminar, Swarthmore College, Swarthmore, PA
Oct 2022	*Exploring synchrony in the brain through mathematical modeling,* Pi Mu Epsilon Induction Ceremony, Saint Michael's College, Colchester, VT
Apr 2022	*Development of orientation preference in mice: a mathematical model,* RWTH Aachen University EDDy Seminar, (Virtual)
Oct 2020	*A simple mathematical model of synapse formation in the developing visual cortex of mice,* Applied Mathematics Seminar, UNC Chapel Hill, NC (Virtual)
Nov 2019	*Modeling visual circuit development of mice through synaptic plasticity,* Simons Collaboration on the Global Brain Postdoc Meeting, New York, NY
Oct 2019	*Do mice and cats see eye-to-eye?,* Mathematics Colloquium, Williams College, Williamstown, MA
Jun 2019	*Introduction to computational neuroscience,* Undergraduate Summer Research Seminar, Courant Institute, NY
Feb 2018	*Circadian rhythmicity of pain sensitivity: A firing-rate model of dorsal horn circuitry* Computational Biology Seminar, Courant Institute, NY
Mar 2017	*The role of gap junctions in synchronizing neuronal activity* Oxford College of Emory University Colloquium, Oxford, GA
Jan 2017	*An Investigation into the role of gap junctions in synchronizing neuronal activity* Marist College Seminar Series, Poughkeepsie, NY

Selected Invited Conference talks

Oct 2024	*Modeling the activity-dependent effect of retinal waves on circuit formation in the visual cortex,* AMS Eastern Sectional Meeting, Albany, NY
Jan 2023	*Mathematical modeling in the brain: investigating the formation of network connections,* Joint Mathematics Meetings (JMM), Boston, MA
June 2021	*Firing-rate models for analyzing spinal circuit motifs underlying chronic pain,* Society for Mathematical Biology (SMB) Annual Meeting, (Virtual)
Jul 2019	*Modeling visual circuit development of mice through synaptic plasticity,* Society for Mathematical Biology (SMB) Annual Meeting, Montreal, CAN
May 2019	*Modeling gap junctions in the cortex,* SIAM Conference on Applications of Dynamical Systems, Salt Lake City, UT
Aug 2018	*Gap junctions between pyramidal cells in cortical neuronal networks,* SIAM Conference on the Life Sciences, Minneapolis, MN
Jun 2017	*Synchrony among synaptically and electrically connected neurons in the cortex* Third International Conference on Mathematical Neuroscience, Boulder, CO

Selected Contributed Conference Presentations

Oct 2024	*Mathematical Model of stage II retinal waves and their effect on the development of receptive fields for neurons in primary visual cortex (poster)*, Society for Neuroscience (SFN) Annual Meeting, Chicago, IL
Jun 2024	*A functional role for stage II retinal waves on the receptive field development of neurons in primary visual cortex (poster)*, International Conference on Mathematical Neuroscience, Dublin, Ireland
Nov 2022	*Mathematical modeling approach to investigating inhibitory plasticity in the visual cortex (poster)*, Society for Neuroscience (SFN) Annual Meeting, San Diego, CA
Aug 2022	*Plasticity among neurons in the visual cortex during development: a mathematical modeling approach (poster)*, MathFest, Philadelphia, PA
Oct 2021	*Mathematical modeling of neuronal networks*, Fall Faculty Forum, Middlebury, VT
Nov 2018	*A mathematical model for the circadian rhythmicity of pain sensitivity in the dorsal horn (poster)*, Society for Neuroscience (SFN) Annual Meeting, San Diego, CA

Awards & Honors

2023 - present	Jeanne Epp Barksdale Junior Faculty Fellowship, $6,000 yearly development fund.
May 2023	Perkins Award for excellence in teaching, $5,000 development fund.
Fall 2021	Middlebury CTLR Pedagogy Enrichment Funds.
2017 - 2020	National Science Foundation Mathematical Sciences Postdoctoral Fellowship, $150,000, DMS-1703761.
May 2017	Joaquin B. Diaz Thesis Prize at Rensselaer Polytechnic Institute
Apr 2015	Student Paper Award at the Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory in Athens, GA

Mentoring Experience

Research Mentor/Advisor to:

Summer 2024	Liza Platonov & Riley Hale, Middlebury: Undergraduate RAs working on modeling gap junction (GJ) gating dynamics.
Winter 2024	Lila Kosowsky & Izzy Pentony, Middlebury: Undergraduate RAs focused on inhibitory plasticity
2021 - 2023	Alex Ginsberg, University of Michigan A PhD student at UMich advised by Victoria Booth. I served as a mentor and committee member for his thesis, defended in July 2023.
Summer 2022	Ai Hattori, Middlebury Undergraduate RA modeling the effect of GJs in epileptic seizures.
Summer 2022	Daniel Ellison, Middlebury Undergraduate RA investigating two plasticity rules
2021 - 2022	Carrie Vanty, Middlebury Undergraduate RA who developed a mathematical model to explore the interaction of sleep and pain.
Summer 2021	Bryan Currie, Middlebury Undergraduate RA modeling the synchronization properties of neurons coupled by a GJ.
Summer 2021	Ben Elstner, Middlebury) Undergraduate RA characterizing inhibitory STDP.
Summer 2019	Paulina Czarnecki, University of Michigan Undergraduate RA at Courant summer program focused on modeling the electrophysiological properties of a Merkel cell.
Summer 2018	Taylor Meredith, Courant Undergraduate student at Courant focused on modeling the neuromuscular disease Myasthenia Gravis and its treatment.

Workshops

Oct 2024	*OCCTIVE Workshop: teaching computing outside of computer science courses* Union College, Schenectady, NY
Jun 2021	*SIMIODE Developer's Workshop: Differential Equations Model and Resource Creators* SIMIODE, (Virtual)
Mar 2021	*Mathematical and computational approaches to social justice* ICERM at Brown University, Providence, RI (Virtual)
Sep 2019	*Statistical model fitting* NYU Center for Neural Science, New York, NY
Jul 2018	*Crime in Santa Monica* AMS-MRC: Agent-based modeling in Biological and Social Systems, Whispering Pines, RI
Aug 2015	*Understanding neuromechanical processes in locomotion with physical modeling and network analysis* SAMSI: Challenges in Computational Neuroscience (CCNS)
Jun 2015	*Sleep, circadian rhythms and pain* A Research Collaboration Workshop for Women in Mathematical Biology, NIMBioS, Knoxville TN
May 2015	SIAM Workshop on Network Sciences, Salt Lake City, UT

Organizing Activities

Jan 2023	Co-organizer of a panel session *Advancing your Career: Integrating Scholarship, Teaching, and Service* Joint Mathematics Meetings, Boston, MA
May 2021	Co-organizer of a minisymposium *New dynamical systems frameworks for investigating neuronal network computations*, SIAM conference on Applications of Dynamical Systems, virtual
Jul 2019	Co-organizer of a minisymposium *Mathematical modeling of neuronal networks*, SMB Annual Meeting, Montreal, CAN
May 2019	Co-organizer of a minisymposium *Neuronal Computations in Brain Networks*, SIAM Conference on Applications of Dynamical Systems, Salt Lake City, UT
Aug 2018	Co-organizer of a minisymposium *Information Processing in Neuronal Networks*, SIAM Conference on the Life Sciences, Minneapolis, MN
May 2017	Co-organizer of a minisymposium *Computational models of neuronal connectivity in the brain*, SIAM Conference on Applications of Dynamical Systems, Salt Lake City, UT

Travel Grants

May 2019	*SIAM Early Career Travel Award*
Jan 2019	*AMS-MRC Travel Award*
Jul 2018	*Institute of Natural Sciences (INS) Travel Award*
Aug 2018	*SIAM Early Career Travel Award*

Service & Outreach

Dec 2024	Judge for SCUDEM undergraduate mathematical modeling competition.
2022 - present	Middlebury AWM student chapter faculty advisor.
Aug 2022	Judge for MathFest undergraduate poster session.
Jun 2022	Panelist for CTLR Graduate School Panel.
May 2022	External committee member for thesis student Majd Hamdan in Physics at Midd.
Apr 2021	Judge for Midd Hackathon
Apr 2021	Intro to mathematical modeling talk for Midd math club
2020-2021	College Street Children's Center Board Member
2020-2021	1000 Girls 1000 Futures Mentor to high school students
Apr 2019	Mathematical Modeling course at Courant Splash! for high school students
Mar 2018	Keynote Speaker at Marist College Pi Mu Epsilon Honor Society Induction Ceremony,
2017- 2020	NYUrWIS Girls Mentor
Jan 2019	Judge for JMM undergraduate poster session
Apr 2018	Judge at The Scientista Symposium

Journals refereed: PAIN, PLoS Computational Biology, Physical Review E, Cognitive Neurodynamics, PLoS One, SIAM Journal on Applied Dynamical Systems.

Professional Development

Spring 2024	*ELP Fellow*
2022-2023	*MAA Project NExT Fellow*
Summer 2022	*WRP Anti-Racist Pedagogy Fellow*
Fall 2021	*National Center for Faculty Development and Diversity Faculty Success Program*
Aug 2021	*CTLR Annual Teaching and Writing Retreat.*
Jan 2021	*CTLR Contemporary Teaching in the Liberal Arts Series, Pandemic Teaching.*
Jul 2020	*DLINQ Camp Design Online.*