GRADUATE PROGRAM IN NEUROSCIENCE

COMPUTATIONAL NEUROSCIENCE GROUP

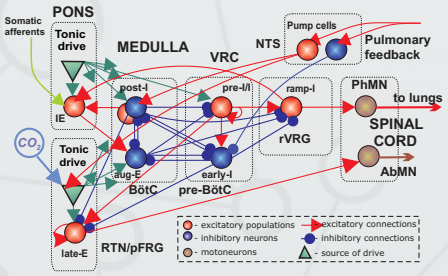
DREXEL UNIVERSITY
Graduate School of
Biomedical Sciences and Professional Studies
College of Medicine

OUR MISSION

To bring together computational and experimental scientists and use collaborative, interdisciplinary approaches to study mechanisms in the intact and injured nervous system and in neurological disorders.

ABOUT US

The Computational Neuroscience Center at Drexel's Department of Neurobiology and Anatomy brings together a group of computational and experimental researchers with a common interest in understanding nervous system function. Members of the center work in close collaboration on multidisciplinary research projects combining experimental and computational strategies.

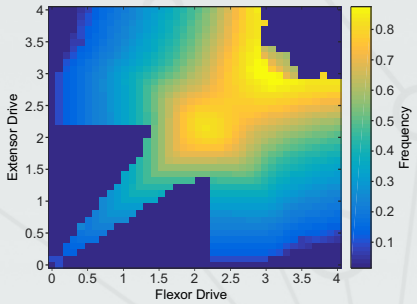


Complex interactions can be investigated using computational models

OUR RESEARCH

Understanding the mechanisms by which the nervous system processes information and how neural circuits control behavior is at the core of neuroscience. Computational neuroscience complements experimental studies by providing important tools to derive new hypotheses, guide experiments to test them, and provide insight into underlying mechanisms.

With the increasing complexity and volume of datasets generated by cutting-edge experimental methods, computational modeling is an indispensable tool to structure and interpret data with the goal of inferring underlying neuronal processes, functions of neural circuits, and ultimately behavior.



Computational models can be used to explore parameter spaces

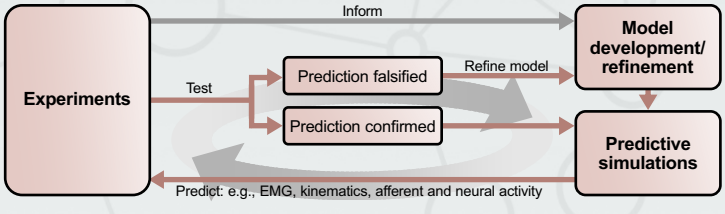
In close collaboration with the Marion Murray Spinal Cord Research Center, Drexel Neuroengineering, and with experimentalists, engineers and computational neuroscientists within Drexel and from across the world, we use collaborative, interdisciplinary computational and experimental approaches to study nervous system function with a focus on the following research areas and methodologies:

- Learning and memory
- Locomotion
- Modularity
- Motor control
- Neuromechanics
- Neural oscillations
- Respiration
- Sensorimotor integration
- Sensory processing
- Spinal cord injury
- Visual processing
- Circuit analysis
- Conductance-based models
- Data science/modeling
- Dynamical systems modeling
- Large-scale population models
- Machine learning (artificial intelligence)
- Neuronal network models
- Neuromechanical models
- Robotics
- Single neuron models

OUR COLLABORATIVE APPROACH

For several decades, data-driven computational modeling has complemented experimental studies by providing a mechanistic rationale for experimental observations, deriving experimentally testable predictions, developing new hypotheses, and generally structuring experimental results and guiding neuroscience research. Our group capitalizes on this synergistic relationship with a focus on the generation of future fundamental insights in neuroscience research.

Our collaborative, integrated research program allows for the deep investigation of the "what", "how and "why" of neurophysiological processes and their underlying principles.



The iterative integration of computational modeling with experimental studies helps provide proofs-of-concept for hypotheses, identify missing information, and derive predictions that then can be tested experimentally: a truly synergistic relationship.

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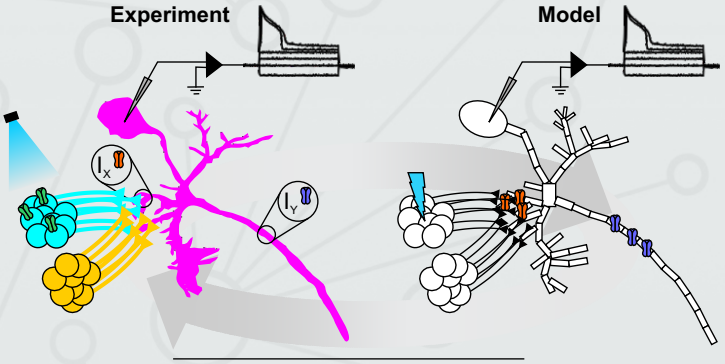
FACULTY RESEARCH INTERESTS

Core Faculty:

- Jessica Ausborn, PhD: Computational modeling of neurons and their interactions; brainstem and spinal control of locomotion and respiration; sensorimotor integration; behavior selection
- Simon M. Danner, PhD: Computational modeling of locomotor spinal circuitry; neuromechanical models; circuit mechanisms of sensorimotor integration; spinal cord injury
- Simon Giszter, PhD: Modularity; primitives; circuit analysis; compositionality; neuromechanics; motor control
- Sergey Markin, PhD: Computational modeling of locomotor circuits; biomechanical models; robotics
- Ilya Rybak, PhD: Computational modeling of neurons, neural circuits, and neural systems at different temporal and spatial scales; central pattern generators; neural oscillations; motor control; neural control of locomotion in animals and robots; neural control of breathing; visual perception and image recognition
- Natalia Shevtsova, PhD: Computational modeling of single neurons and neural networks; neural control of respiration and locomotion

Experimental Affiliates:

- Tatiana Bezdudnaya, PhD: Respiratory neurobiology and respiratory plasticity after spinal cord injury
- Kimberly Dougherty, PhD: Spinal locomotor circuits and their function in health, injury and disease
- Catherine von Reyn, PhD: sensorimotor integration; neural circuit development
- Dong Wang, PhD: Learning and memory; neural oscillations

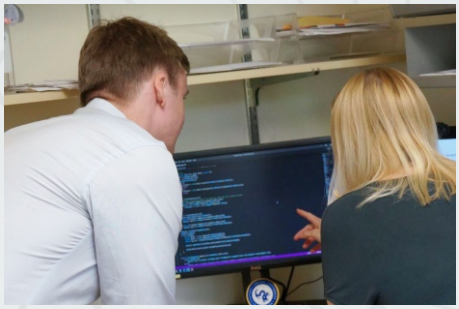


Computational models can be used to parallel experimental manipulations while providing a rigorous framework for the exploration of underlying mechanisms and key components.

OUTLOOK FOR OUR TRAINEES

Our graduate students have the opportunity to work on multidisciplinary projects in a number of research fields using a wide array of computational tools and techniques. Due to the group's focus on collaborative approaches, trainees will learn first-hand about the interdisciplinary aspects of computational neuroscience research, work closely with our experimental collaborators, or even have the opportunity to be trained on both experimental and computational approaches.

Trainees are encouraged to present their work at scientific conferences.



A collaborative and collegial atmosphere is important to all members of the group

Students have the opportunity to present at national and international conferences to network with leaders in the field and in industry. We are committed to individually mentoring our students so that they can succeed not only in their graduate studies but also beyond in their chosen career goals.

We welcome trainees from various backgrounds, including but not limited to neuroscience, computer science, and different engineering disciplines.

We would love for you to join our team.

Get in Touch

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