Habitually Curious: The Neurological Basis for Habit Formation
Talia Lerner, PhD, Assistant Professor of Physiology

Q&A

What are your research interests?
I’m very interested in habit formation; the process by which behavior becomes automatic. Habit formation is an essential survival strategy in a complex world. It’s also an interesting behavior because it sits at the interface between reward learning circuits and motor circuits. Feedback, in the form of rewards and punishments, is required in the initial stages of learning a new task, but as actions are repeated they are taken over by motor circuits — streamlined, stereotyped and de-coupled from feedback, leading to inflexible behavior.

My lab wants to know which neural circuits are responsible for this complex process of habit formation. How do neural circuits weigh the costs and benefits of automaticity and use feedback from the environment to regulate the formation of habits over time?

We already have some insight into this: We know that habit formation requires the striatum, the input nucleus of the basal ganglia, as well as dopamine inputs to the striatum from the substantia nigra pars compacta (SNc). Previously, I identified two parallel SNc dopamine neuron subpopulations projecting to the dorsomedial striatum and dorsolateral striatum, publishing these findings in the journal Cell. These populations differ in their biophysical properties, input wiring and natural activity patterns during free behavior.

They are also interconnected with each other, suggesting possible routes of information transfer during habit formation. To test our hypotheses, my lab is examining how the properties of dopamine neuron subpopulations — and their interconnections with the striatum — change with habit formation, and how forces such as stress and drug exposure alter the course of learning by acting on these circuits.

What is the ultimate goal of your research?
My work provides an important foundation for future studies of the roles that habits play in a range of psychiatric diseases, including obsessive-compulsive disorder and drug addiction. As our studies progress, they will provide insight into the circuit-level etiology of human mental disorders and help us to design circuit-based therapies.

My lab is also very interested in individual differences in circuit structure that might predispose one towards disease. Ultimately, I think my studies could help provide information for risk screening as well as for the selection of personalized treatment plans in human patients.

What do you enjoy about teaching and mentoring young scientists in the lab?
Young scientists bring new energy to a project; when a person is new to a field, they often can be their most creative. It’s my job and privilege to channel that creativity into a concrete project and to make sure it fits into the bigger picture of what the lab is trying to accomplish.

I’m also proud to be a female role model in science and to model other behaviors that I’d like to see in the next generation of scientists, such as openness and inclusivity. I care a lot about diversity in science and about bringing new voices to the table. I hope to use my teaching and mentoring capacities at Northwestern to support young scientists from a variety of backgrounds.
Lerner
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How is your research funded?
My research program so far has been generously funded by the National Institute of Mental Health and by the Brain & Behavior Research Foundation. As a new investigator, I’m also grateful for support from Northwestern and from the Searle Leadership Fund.

What resources at Northwestern have been helpful for your research?
Northwestern has been an incredibly supportive environment in which to start my research program. In particular, the Center for Advanced Microscopy has been crucial for allowing my lab to image and map whole-brain dopamine circuits. We’ve also been supported by Quest, the high-performance computing cluster, and by many, many helpful colleagues both in Chicago and Evanston.

Cancer Patients Guaranteed Oncofertility Treatment Coverage Under New Illinois Law
Illinois cancer patients no longer have to choose between costly life-saving treatments and preserving their ability to one day have their own biological children, thanks to a fertility preservation bill signed Aug. 27 by Gov. Bruce Rauner at Northwestern Medicine Prentice Women’s Hospital.

HB 02617, based in part on research and advocacy at Northwestern University, amends the Illinois insurance code to require oncofertility coverage.

Read the full coverage here.

Funding

Clinical Trial on Effects of Statins in Older Adults Without Clinical Cardiovascular Disease (U19 Clinical Trial Required)

More information
Sponsors: National Institute on Aging (NIA), National Heart, Lung, and Blood Institute (NHLBI), and National Institute on Neurological Disorders and Stroke (NINDS)
Letter of Intent Due: November 17
Submission Deadline: December 17
Amount: $2.8M in direct costs in FY2019 to fund one award
Synopsis: NIA, NHLBI and NINDS request applications for a pragmatic trial from a network or consortium of healthcare delivery systems, which together cover most of the geographic regions of the United States, and a data coordinating center to assess the overall risks and benefits of statins in adults 75 years of age and older without clinical cardiovascular disease.

Stroke Preclinical Assessment Network (SPAN) to Support Translational Studies for Acute Neuroprotection (U01 Clinical Trial Not Allowed)

More Information
Sponsors: National Institute of Neurological Disorders and Stroke (NINDS)
Letter of Intent Due: November 13
Submission Deadline: December 13
Amount: $725,000 in direct costs over a period of three years ($75,000 direct cost during year one to set up the network, then $325,000 in direct costs per year)
Synopsis: Applications of promising neuroprotective drugs/interventions for the Stroke Preclinical Assessment Network (SPAN) are solicited. SPAN will support late-stage preclinical studies of putative neuroprotectants to be given prior to or at the time of reperfusion, with clinically relevant long-term outcomes and comorbidities. Parallel testing of the most promising interventions will help to determine if an intervention can improve outcome as compared to reperfusion alone and/or extend the therapeutic window for reperfusion, and if so, guide the selection of the best agent(s) to transition to future Phase II clinical trials.

Pediatric Immunotherapy Discovery and Development Network (PI-DDN) (U54 — Clinical Trial Not Allowed)

More Information
Sponsors: National Cancer Institute
Letter of Intent Due: 30 days prior to the application due date
Submission Deadline: December 17
Amount: $2.5M in FY2019 with future year amounts depending on annual appropriations for a maximum project period of five years
Synopsis: Associated with the Beau Biden Cancer MoonshotSM Initiative that is intended to accelerate cancer research, the purpose of funding is to establish centers of collaborating investigators with the goal of identifying and advancing research opportunities for translating immunotherapy concepts for children and adolescents with cancer toward clinical applications.

View more funding opportunities