

Isabella P. Fallon PhD – Duke University, Neurobiology

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RESEARCH INTERESTS

My research advances our understanding of the neural mechanisms underlying skilled movements and action sequences. Combining expertise in neural circuit manipulation, activity monitoring, and continuous behavioral tracking, I have developed a concise model of how neural circuits affected by Parkinson's disease impact movement and action selection. In the future, I want to translate these neurobiological insights into biomedical technologies that restore and enhance nervous system function.

EDUCATION

Duke University School of Medicine, Durham, North Carolina

Ph.D., Neurobiology, May 2024

- Dissertation Title: Striatal Pathways for Action Counting and Steering
- Advisor: Henry Yin
- Committee: Nicole Calakos, Michael Tadross, and Rebecca Yang

University of Colorado Boulder, Boulder, Colorado

B.A., Psychology and Neuroscience

- Dissertation Title: Evaluating Stressor Controllability Effects in Female Rats
- Advisor: Steven Maier
- Committee: Kathryn Plath, Heidi Day, Michael Baratta

RESEARCH EXPERIENCE

Duke University, Yin Laboratory

Advisor: Henry Yin

Postdoctoral Researcher

2024 – Present

- Developed a closed-loop sensor-actuator system for reach-to-target experiments in pre-clinical models
- Implemented deep learning-based pose estimation algorithms for analyzing dexterous movements
- Measured and manipulated genetically distinct cell populations to determine their role in dexterous movements
- Mentored PhD students on research methodologies, experimental design, and career development

Duke University School of Medicine, Yin Laboratory

Advisor: Henry Yin

Graduate Student

2019 – 2024

My research focused on the mechanisms by which the nervous system generates action. I focused on the direct and indirect pathways of the Basal Ganglia and how they contribute to action selection, kinematics and coordinating sequences of actions. My research identified a novel and simple 'push-pull' model for striatal circuits that predicts action selection and movement trajectories.

- Designed a behavioral task for preclinical models that improved measures of decision making and kinematics
- Measured neural activity using *in-vivo* calcium imaging and discovered distinct subpopulations
- Manipulated neural activity with optogenetics and revealed distinct contributions
- Developed a 'push-pull' model of how different neural populations predict movement trajectories

University of Colorado Boulder & UC Denver, Maier &

Greenwood Laboratory

Advisor: Steven Maier

Professional Research Associate

Spring 2017 – Fall 2019

- Investigated the prophylactic effects of exercise on traumatic stress

University of Colorado Boulder, Maier Laboratory

Advisor: Steven Maier

Undergraduate Research Assistant

Fall 2014 – Fall 2017

- Implemented the first experiments with female preclinical rodent models in a stress lab and discovered sex differences in stress outcomes
- Leveraged pharmacology and immunofluorescence to understand neural contributions and discovered differences in dopamine signaling

Anschutz Medical Campus, Todorovic Laboratory

Advisor: Slobodan Todorovic

Undergraduate Research Assistant

Summer 2016

- Explored the role of CaV3.2 channels in pain transmission and explored mechanisms of endogenous CaV3.2 channel modulation.

TECHNICAL SKILLS

- Laboratory techniques: behavioral testing & apparatus engineering (operant conditioning, pavlovian conditioning, restraint stress, shuttle box escape, juvenile social exploration, tail suspension, conditioned place preference, open-field, radial arm maze, chronic unpredictable stress, water reaching), optogenetics, chemogenetics, electrophysiology, endoscopic calcium imaging, fiber photometry, pharmacology, inducible systems for activity-dependent labeling, confocal microscopy, viral-mediated gene delivery, anatomical tract tracing, immunofluorescence.
- Data Analysis software & programming: Med-Associates programming, Python, MATLAB, Arduino C++, NeuroExplorer, Adobe illustrator, Adobe Premiere Pro, Visual Studio, Adobe Acrobat, GraphPad, ImageJ, Plexon, Minian (Ca analysis), DeepLabCut (2D&3D pose estimation), all google programs.

PEER-REVIEWED JOURNAL PUBLICATIONS

1. **Fallon IP**, Dolzani SD, Leslie NR, Amat J, Trahan GD, Laynes RA, Watkins LR, Maier SF, Baratta, MV. Coping with stress promotes long-term resilience through distinct prefrontal circuits. (2025). *In preparation*.
2. **Fallon IP**, Roshchina M, Hong F, Fernandez SO, Ruan S, Yin HH. Striatal pathways for action counting and steering. (2024). *Under review Nature Neuroscience*.
3. Sanner K, Kawell S, Evans JG, Elekovic V, Walz M, Joksimovic SL, Joksimovic SM, Donald RR, Tomic M, Orestes P, Feseha S, Dedek A, Ghodsi SM, **Fallon IP**, Lee J, Hwang SM, Hong SJ, Maslanka M, Covey DF, Romano C, Stamenic TT, Zorumski CF, Stowell MHB, Hildebrand M, Eisenmesser EZ, Jevtovic-Todorovic V, Todorovic SM. (2024). Facilitation of CaV3.2 channel gating in pain pathways reveals a novel mechanism of serum-induced hyperalgesia. *Under review Neuron*.
4. Bakhurin K, Hughes, RN, Jiang Q, **Fallon IP** Yin, HH. [Force tuning explains changes in phasic dopamine signaling during stimulus-reward learning](#). (2023). *Under review Nature Communications*.
5. Tanner MK, Mellert SM, **Fallon IP**, Baratta MV, Greenwood BN. [Multiple Sex- and Circuit-Specific Mechanisms Underlie Exercise-Induced Stress Resistance](#). (2024). *Exercise and Mental Health*.
6. **Fallon IP**, Hughes RN, Severino FPU, Kim N, Lawry CM, Watson GDR, Roschina M, Yin HH. [The role of the parafascicular thalamic nucleus in action initiation and steering](#). (2023). *Current Biology*.
7. Zhang J, Hughes RN, Kim N, **Fallon IP**, Bakhurin K, Kim J, Severino FPU, Yin HH. [A one-photon endoscope for simultaneous patterned optogenetic stimulation and calcium imaging in freely behaving mice](#). (2023). *Nature Biomedical Engineering*.
8. Petter EA, **Fallon IP**, Hughes RN, Watson GDR, Meck WH, Ulloa Severino FP, Yin HH. [Elucidating a locus coeruleus-dentate gyrus dopamine pathway for operant reinforcement](#). (2023). *Elife*.
9. Hassell JE, Baratta MV, **Fallon IP**, Siebler PH, Karns BL, Nguyen KT, Gates CA, Fonken LK, Frank MG, Maier SF, Lowry CA. [Immunization with a heat-killed preparation of Mycobacterium vaccae NCTC 11659 enhances auditory-cued fear extinction in a stress-dependent manner](#). (2022). *Brain Behavior and Immunity*.

10. McNulty CJ*, **Fallon IP***, Amat J, Sanchez RJ, Leslie NR, Root DH, Maier SF, Baratta MV. [Elevated prefrontal dopamine interferes with the stress-buffering properties of behavioral control in female rats.](#) (2022). *Neuropsychopharmacology*.
11. Watson GDR, Hughes RN, Petter EA, **Fallon IP**, Kim N, Severino FPU, Yin HH. [Thalamic projections to the subthalamic nucleus contribute to movement initiation and rescue of parkinsonian symptoms.](#) (2021). *Science Advances*.
12. Frank MG, Baratta MV, Zhang K, **Fallon IP**, Pearson MA, Liu G, Hutchinson MR, Watkins LR, Goldys EM, Maier SF. [Acute stress induces the rapid and transient induction of caspase-1, gasdermin D and release of constitutive IL-1 \$\beta\$ protein in dorsal hippocampus.](#) (2020). *Brain Behavior and Immunity*.
13. **Fallon IP**, Tanner MK, Greenwood BN, Baratta MV. (2019). [Sex differences in resilience: experiential factors and their mechanisms.](#) *European Journal of Neuroscience*.
14. Tanner MK, **Fallon IP**, Baratta MV, Greenwood BN. [Voluntary exercise enables stress resistance in females.](#) (2019). *Behavioural Brain Research*, 369.
15. Baratta MV, Leslie NR, **Fallon IP**, Dolzani SD, Chun LE, Tamalunas AM, Watkins LR, Maier SF. (2018). [Behavioural and neural sequelae of stressor exposure are not modulated by controllability in females.](#) *European Journal of Neuroscience*.

CLINICAL EXPERIENCE

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| Duke University Department of Neurosurgery, Shadow Neurosurgery | Spring 2025 – Current |
| <ul style="list-style-type: none"> Gaining exposure to deep brain stimulation and spinal cord stimulation surgeries | |
| Anderson Medical Center, Medical Scribe Cardiology | Summer 2017 – Fall 2017 |
| <ul style="list-style-type: none"> Documented patient encounters in real-time using electronic health records Transcribed physician notes, diagnoses, and treatment plans Maintained accurate and HIPAA- compliant medical records | |
| Boulder Run Physio, Shadow Physical therapy | Summer 2017 – Spring 2018 |
| <ul style="list-style-type: none"> Observed patient evaluations, treatment plans, and rehabilitation exercises Shadowed therapists during patient care, including manual therapy, mobility exercises, and gait training Gained exposure to a variety of musculoskeletal, neurological, and post-surgical cases | |

PEER-REVIEWED CONFERENCE ARTICLES & ABSTRACTS

1. Yin HH, Bakhurin K, **Fallon IP**, O.Jiang, M.Hossain, B.Gutkin. (Fall 2022). Deconstructing the Reward Prediction Error Hypothesis of Dopamine Function. *Society for Neuroscience*, Chicago, Illinois.
2. **Fallon IP**, Roshchina M, Hong F, Vignali C, Fernandez SO, Yin HH. (Fall 2022). The Role of Striatal Neurons in Counting Behavior. *Society for Neuroscience*, Chicago, Illinois.
3. Hong F, **Fallon IP**, Yin HH. (Fall 2022). Striatal Direct and Indirect Pathway Neurons Play Complementary Roles in Action. *Society for Neuroscience*, Chicago, Illinois.
4. **Fallon IP**, Fernandez SO, Yin HH. (Fall 2022). The striatal indirect pathway resets the neural representation of numerosity. *The Assembly and Function of Neuronal Circuits*, Ascona, Switzerland.
5. **Fallon IP**, Fernandez SO, Yin HH. (Fall 2022). The striatal indirect pathway resets the neural representation of numerosity. *Society for Neuroscience*, San Diego, California.
6. Bakhurin K, Hughes RN, **Fallon IP**, Yin HH. (Fall 2022). Ventral tegmental dopamine neurons signal force vector dynamics during Pavlovian conditioning and performance. *Society for Neuroscience*, San Diego, California.
7. McNulty CJ, **Fallon IP**, Amat J, Sanchez RJ, Root DH, Maier SF, Baratta MV. (Fall 2022). Behavioral control over stress recruits a distinct circuit in females. *Society for Neuroscience*, San Diego, California.
8. Bonar KK, Tanner MK, **Fallon IP**, Baratta MV, Greenwood BN. (Fall, 2019). Exercise effects on activation of dorsal raphe nucleus-projecting neurons during uncontrollable stress. *Front Range Neuroscience Group*, Fort Collins, CO.
9. **Fallon IP**, Levy ES, Dolzani SD, Leslie NR, Amat J, Trahan GD, Laynes RA, Watkins LR, Baratta MV, Maier SF. (Fall, 2019). Control over stress engages a corticostriatal projection for the production of long-term stress resilience. *Ascona Circuits Meeting*, Monte Verita, Switzerland.

10. **Fallon IP**, Tanner MK, Tamalunas AM, Baratta MV, Greenwood BN (Fall, 2019) Voluntary wheel running prevents the behavioral and neurochemical sequelae of uncontrollable stress in females. *Society for Neuroscience*, Chicago, Illinois.
11. Tanner MK, **Fallon IP**, Baratta MV, Greenwood BN. (Fall, 2018) Wheel running prevents the negative impact of stressor exposure in females. *Front Range Neuroscience Group*, Fort Collins, Colorado.
12. Levy ES, **Fallon IP**, Baratta MV, Leslie NR, Watkins LR, Maier SF. (Fall, 2018). Determining prefrontal projections involved in the production of long-term stress resilience. *Molecular and Cellular Cognition Society*, San Diego, California.
13. Baratta MV, Dolzani SD, **Fallon IP**, Leslie NR, Amat J, Trahan GD, Laynes RA, Watkins LR, Maier SF. (Fall, 2018). Control over stress engages a corticostriatal projection for the production of long-term stress resilience. *Society for Neuroscience*, San Diego, California.
14. **Fallon IP**, Baratta MV, Leslie NR, Dolzani SD, Chun LE, Tamalunas AM, Watkins LR, Maier SF. (Summer, 2018). Behavioral and neural sequelae of stressor exposure are not modulated by controllability in females. *Neurobiology of Stress Workshop*, Banff, Canada.
15. **Fallon IP**, Baratta MV, Leslie NR, Dolzani SD, Chun LE, Tamalunas AM, Watkins LR, Maier SF. (Fall, 2017). Evaluating Stressor Controllability Effects in Female Rats. *Society for Neuroscience*, Washington D.C.

INVITED TALKS

1. **“Striatal mechanisms underlying counting behavior”**. Seminar series, Duke University School of Medicine, Durham, North Carolina. 2023
2. **“Investigating the role of striatal indirect pathway neurons in quantity estimation”**. Basal Ganglia Symposium, Duke University School of Medicine, Durham, North Carolina. 2022
3. **“Control over stress engages a corticostriatal projection for the production of long-term stress resilience”**. Ascona Circuits Meeting, Monte Verita, Switzerland. 2019
4. **“Evaluating Stressor Controllability Effects in Female Rats”**. Rocky Mountain Regional Neuroscience Group, University of Colorado Anschutz Medical Campus, Denver, Colorado. 2017

HONORS & AWARDS

Women Who Make a Difference (\$1,000)	2018
Biological Science Initiative Travel Grant (\$800)	2017
Best Abstract Award, Rock Mountain Regional Neuroscience Group	2017
Best Undergraduate Thesis in Neuroscience Award (\$1,500)	2017
Undergraduate Research Opportunities Program Research Assistantship Award (\$1,200)	2016
Undergraduate Research Opportunities Program Individual Grant (\$1,000)	2016
Undergraduate Research Opportunities Program- HHMI Research Grant (\$2,000)	2015
Biological Science Initiative Scholars Program Summer Award Research Grant (\$500)	2015

TEACHING EXPERIENCE

Duke University School of Medicine, NEUROBIO 719 Concepts in Neuroscience II Teaching Assistant to Professor Kevin Franks Spring 2021

- Assisted students in understanding homework material and learning the lectures
- Graded student assignments
- Presented students with methods for designing a research proposal

Duke University School of Medicine, Duke Athletics

Tutor to football and soccer student athletes

Fall 2020- Spring 2021

- Organized weekly meetings to review lecture material
- Helped students organize their notes and develop strategies for remembering material
- Educated students on topics including neuroanatomy, neurobiology, neuro-ethics, and psychology

SUPERVISION OF UNDERGRADUATE MENTEES

Duke University, URS Assistantship, Sofia O. Fernandez

Spring 2022 – Fall 2024
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Duke University, Pierce Hollier
University of Colorado Boulder, UROP Assistantship Emily Levy

Spring 2021 – Spring 2022
Spring 2018 – Fall 2019

SUPERVISION OF GRADUATE MENTEES

Duke University, Feiyang Hong
Duke University, Qiaochu Jiang

Spring 2021 – Present
Winter 2024 – Present

RELATED WORK EXPERIENCE

University of Colorado Boulder, Special Undergraduate Enrichment Programs

Advisory Board Member and Website Manager

2015-2016

- Promoted undergraduate research on the CU Boulder campus and facilitate faculty-student partnerships
- Managed the program's communications using the platform Web Express powered by Drupal

COMMUNITY SERVICE & LEADERSHIP

Duke University, Nucleate leadership team

Communications team

Fall 2020 – Summer 2021

- Coordinated communication between local biotech companies, researchers at institutions, students in biomedical PhDs, and the Fuqua School of Business
- Engaged in training on student support, facilitating group dynamics, and fostering interpersonal relationships

PROFESSIONAL DEVELOPMENT

Duke Innovation and Entrepreneurship startup sprint

May 2025

The Inaugural Raynor Cerebellum Project Postdoc Summit, Scottsdale, AZ

November 2024

Neurobiology Retreat, Wilmington, NC

October 2024

Accelerate to Industry, Durham, NC

May 2023

The responsible scientist II, Duke University, BIOTRAIN 754

Spring 2023

Responsible conduct in research, Duke University, GS 710A

Fall 2020

Neurobiology Retreat, Wilmington, NC

Fall 2019

Responsible conduct in research, Duke University, GS 714

Fall 2019

REFERENCES

Professor Henry Yin

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Assistant Professor Michael Baratta

Department of Psychology and Neuroscience, University of Colorado Boulder

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Distinguished Professor Stephen Lisberger

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