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, learning, and decision-making. Combining expertise in neural circuit manipulation, activity monitoring, and continuous behavioral tracking, I have developed a clear and concise model of how circuits affected by Parkinsons disease impact movement and decision-making. In the future, I want to translate 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
- Executed a strategy to investigate the role of basal ganglia neurons in dexterous movements
- Measuring and manipulating genetically distinct cell populations to determine their role in dexterous movements
- Mentoring 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 decision making, kinematics and coordinating sequences of actions. My research identified a novel and simple 'push-pull' model for striatal circuits that predicts decision making and movement trajectory.
- Designed a behavioral task for preclinical rodent 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 of temporally distinct neural populations
- Analyzed data and developed a 'push-pull' model based off of anatomy that explains how the direct and indirect pathways function together to regulate action

University of Colorado Boulder & UC Denver, Maier & Greenwood Laboratory
Advisor: Steven Maier
Professional Research Associate Spring 2017 – Fall 2019
- My project focused on the prophylactic effects of exercise on traumatic stress and the related neurobiological mechanisms

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.

PEER-REVIEWED JOURNAL PUBLICATIONS

1. **Fallon IP**, Fernandez SO, Hong F, Yin HH. Striatal pathways regulate reach flexion and extension. (2024). ***In preparation.***
2. **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. (2024). ***In preparation.***
3. **Fallon IP**, Roshchina M, Hong F, Fernandez SO, Ruan S, Yin HH. Striatal pathways for action counting and steering. (2024). ***Under review Nature.***
4. 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.***
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. Bakhurin K, Hughes, RN, Jiang Q, **Fallon IP** Yin, HH. Force tuning explains changes in phasic dopamine signaling during stimulus-reward learning. (2023). ***Biorxiv.***
8. 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.***
9. 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.***
10. 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.***
11. 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.***
12. 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.***
13. 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-1β protein in dorsal hippocampus. (2020). ***Brain Behavior and Immunity.***

14. **Fallon IP**, Tanner MK, Greenwood BN, Baratta MV. (2019). Sex differences in resilience: experiential factors and their mechanisms. ***European Journal of Neuroscience***.
15. Tanner MK, **Fallon IP**, Baratta MV, Greenwood BN. Voluntary exercise enables stress resistance in females. (2019). ***Behavioural Brain Research***, 369.
16. 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***.

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 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,** Fernandez SO, Yin HH. (Fall 2022). The striatal indirect pathway resets the neural representation of numerosity. *The Assembly and Function of Neuronal Circuits,* Monte Verita, Switzerland.
10. **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.
11. **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.
12. 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.
13. 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.
14. 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.
15. **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.
16. **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.

HONORS & AWARDS

Women Who Make a Difference	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
Tuor 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, productivity, and note-taking.

SUPERVISION OF UNDERGRADUATE MENTEES

Duke University, URS Assistantship, Sofia O. Fernandez	Spring 2022 – Fall 2024
Duke University, Pierce Hollier	Spring 2021 – Spring 2022
University of Colorado Boulder, UROP Assistantship Emily Levy	Spring 2018 – Fall 2019

SUPERVISION OF GRADUATE MENTEES

Duke University, Feiyang Hong Spring 2021 – Present

RESSEARCH RELATED WORK EXPERIENCE

University of Colorado Boulder, Special Undergraduate Enrichment Programs
Advisory Board Member and Website Manager 2015-2016

- Promote 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

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
Responsible conduct in research, Duke University, GS 714	Fall 2019

TECHNICAL SKILLS

- Laboratory techniques: behavioral testing, optogenetics, chemogenetics, *in-vivo* endoscopic calcium imaging, *in-vivo* fiber photometry, pharmacology, inducible systems for activity-dependent labeling, confocal microscopy, viral-mediated gene delivery, anatomical tract tracing, immunofluorescence
- Software: med-associates programming, Minian (Ca analysis), DeepLabCut (2D&3D pose estimation), MATLAB, Python, Dart, HTML, all google programs, NeuroExplorer, Adobe illustrator, Adobe Premiere Pro, Adobe Acrobat, GraphPad, ImageJ, Plexon.

REFERENCES

Professor Henry Yin
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