

# Mark A. Nicholas

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## EXPERIENCE AND EDUCATION

- Doctoral Candidate** - Carnegie Mellon University 2020 - Present  
Thesis: Corticostriatal function during movement and trial and error learning in a dynamic environment  
Advisor: Dr. Eric A. Yttri, Department of Biological Sciences  
Center for the Neural Basis of Cognition
- Research Associate** – Eric Yttri Lab, Carnegie Mellon University 2017 - 2020  
Promoted from Research Associate I to Research Associate II in 2019
- Postbaccalaureate Intramural Research Training Fellow** - NIMH 2015 - 2017  
Laboratory of Neuropsychology, Section on Neurobiology and Learning and Memory  
Advisor: Dr. Elisabeth A. Murray
- Research Assistant** – Sandra Kuhlman Lab, Carnegie Mellon University 2012 - 2015  
Project: Corticocortical feedback-mediated facilitation is cell-type specific and gated by nucleus basalis activity
- Bachelor of Science** - Carnegie Mellon University 2011 - 2015  
Major: Neuroscience, College Honors, Department of Biological Sciences

## AWARDS AND HONORS

- Margaret Carver Travel Grant 2023
- Mellon College of Science Rookie of the Year Finalist 2018, 2019  
*One of 6 employees nominated from the entire college*
- National Institutes of Health Postbaccalaureate Intramural Research Training Award 2015, 2016
- Mellon College of Science College Honors, Carnegie Mellon University 2015
- Senior Leadership Recognition, Carnegie Mellon University 2015  
*“This recognition is reserved for those students who have made an unparalleled impact on our community, leaving CMU a better place as a result of their leadership, vision and initiative”*
- Small Undergraduate Research Grant, Carnegie Mellon University 2015
- Howard Hughes Medical Institute Summer Researcher Grant 2013, 2014

## PUBLICATIONS

1. Kaskan PM\*, **Nicholas MA\***, Dean, AM, Murray, EM. (2022). *Attention to stimuli of learned versus innate biological value rely on separate neural systems*. Journal of Neuroscience (\* contributed equally)

2. Saleh MS\*, Ritchie SM\*, **Nicholas MA\***, Gordon HL\*, Yuan B, Hu C, Jahan S, Bezbaruah R, Reddy JW, Chamanzar M, Yttri EA, Panat RP. (2022). *A 3D Nano-Printed, Highly Customizable High-Density Microelectrode Array Platform*. Science Advances. (\* contributed equally)
3. Belsey P, **Nicholas MA**, Yttri EA. (2020). *Open-source joystick manipulandum for decision-making, reaching, and motor control studies in mice*. eNeuro.
4. Saleh MS, Ritchie S, **Nicholas MA**, Bezbaruah R, Panat R, Yttri EA. (2019). *CMU Array: A 3D Nano-Printed, Customizable Ultra-High-Density Microelectrode Array Platform*. bioRxiv.
5. Belsey P, **Nicholas MA**, Yttri EA. (2019). *Build a better mouse task: can an open-source rodent joystick enhance reaching behavior outcomes through improved monitoring of real-time spatiotemporal kinematics?* bioRxiv.
6. Kaskan PM, Dean MA, **Nicholas MA**, Mitz AR, Murray EA. (2018). *Gustatory responses in macaque monkeys revealed with fMRI: comments on taste, taste preference and internal state*. NeuroImage.
7. Pafundo DE, **Nicholas MA**, Zhang R, Kuhlman SJ. (2016). *Top-Down-Mediated Facilitation in the Visual Cortex Is Gated by Subcortical Neuromodulation*. The Journal Of Neuroscience.
8. **Nicholas MA**, Pafundo DE. (2014). *Can we reorganize the cortex to restore vision in amblyopes?* The Triple Helix, The Journal of Science, Society, and Law at Carnegie Mellon.

## **PUBLICATIONS UNDER REVIEW**

**Nicholas MA**, Yttri EA. *Motor cortex is responsible for motoric dynamics in striatum and the execution of both skilled and unskilled actions*. (Neuron).

## **PUBLICATIONS IN PREPARATION**

1. Hsu AI, **Nicholas MA**, Yttri EA. *Naturalistic action encoding across corticostriatal motor axis*.

## **PRESENTATIONS**

1. **Nicholas MA**, Yttri EA. (2024). *Cell-type-specific corticostriatal dynamics orchestrate trial and error motor learning*. The Society for Neuroscience, poster.
2. **Nicholas MA**, Yttri EA. (2024). *Revealing the corticostriatal dynamics underlying trial and error motor learning by recording concurrently across multiple identified cell types*. Gordon Research Conference, poster.
3. **Nicholas MA**, Yttri EA. (2023). *Concurrent corticostriatal dynamics across multiple cell types underlying trial and error learning*. The Society for Neuroscience, poster.
4. Panat RP, Ritchie SM, **Nicholas MA**, Gordon HL, Yuan B, Hu C, Jahan S, Bezbaruah R, Reddy JW, Chamanzar M, Yttri EA. (2022). *3D Printed Customizable Neural Probes*. 12th International Conference on Microelectrode Arrays for Life Sciences 2022, Poster.
5. **Nicholas MA**, Yttri EA. (2021). *Motor cortex but not parietal lesions severely impair reaching, spontaneous motor decisions and striatal dynamics*. Swedish Basal Ganglia Society, poster.
6. **Nicholas MA**, Yttri EA. (2021). *Motor cortex but not parietal lesions severely impair reaching, spontaneous motor decisions and striatal dynamics*. The Society for Neuroscience, poster.

7. **Nicholas MA.** (2020). *Cortical contributions to movement and striatal activity*. Great Hall Of Brain Science Seminar. Carnegie Mellon, talk.
8. **Nicholas MA,** Belsey P, Yttri EA. (2019). *Causal dissection of cortical-striatal interactions governing the neural circuit control of reaching*. The Society for Neuroscience, poster.
9. Hodge AT, **Nicholas MA,** Dudman JT, Yttri EA. (2019). *Striatal stimulation reinforces, but does not select, naturalistic untrained behavior*. The Society for Neuroscience, poster.
10. **Nicholas MA,** Belsey P, Yttri EA. (2019). *Causal dissection of cortical-striatal interactions governing the neural circuit control of reaching*. CMU Department of Biological Sciences Elizabeth Jones Retreat 2019, poster.
11. Panat R, Saleh MS, Ritchie S, **Nicholas MA,** Bezbaruah R, Yttri EA. (2019). *CMU array: A fully-customizable, ultra-high density invasive electrode for large-scale recording and optical stimulation enabled through nanoparticle 3D printing*. The Society for Neuroscience, talk.
12. **Nicholas MA.** (2019). *Causal dissection of cortical-striatal interactions governing the neural circuit control of reaching during goal directed behaviors*. Great Hall Of Brain Science Seminar. Carnegie Mellon, talk.
13. Saleh MS, Ritchie S, **Nicholas MA,** Bezbaruah R, Yttri EA, Panat R. (2019). *CMU Array: A Customizable Ultra-High-Density Optic-Fiber Paired Neural Interface by Nanoparticle 3D Printing*. Biomedical Engineering Society 2019 Annual Meeting, poster.
14. Saleh MS, Bezbaruah R, **Nicholas MA,** Reddy J, Chamanzar M, Yttri EA, Panat R. (2019). *Customizable Ultra-High-Density Optic-Fiber Paired Neural Interfaces by Nanoparticle 3D Printing*. 2019 9th International IEEE/EMBS Conference on Neural Engineering (NER), poster.
15. Saleh MS, **Nicholas MA,** Bezbaruah R, Reddy J, Chamanzar M, Yttri EA, Panat R. (2018). *3D Printed Ultra-High Density, High Aspect Ratio Microelectrode Arrays for Next-Generation Neural Probes and Drug Delivery Applications*. 2018 Materials Research Society, poster.
16. Saleh MS, **Nicholas MA,** Bezbaruah R, Yttri EA, Panat, R. (2018). *Microscale 3D Printing by Additive Nanoparticle Assembly for Energy Storage Systems and Biomedical Devices*. International Mechanical Engineering Congress & Exposition, poster.
17. **Nicholas MA,** Saleh MS, Hodge, AT, Panat R, Yttri EA. (2018). *Customizable, 3D-printed, thousand-channel probes for neural recording and photostimulation*. Cell-NERF Symposium, Neurotechnologies, talk.
18. Kaskan PM, Dean MA, **Nicholas MA,** Mitz AR, Ungerleider LG, Murray EA. (2016) *Gustatory responses in macaque monkeys revealed with fMRI*. The Society for Neuroscience, poster.
19. **Nicholas MA,** Dean MA, Hwang J, Kaskan PM, Murray EA. (2016) *The role of the amygdala in attending to reward predictive visual images*. 18<sup>th</sup> Annual NIMH DIRP Fellows' Scientific Training Day, poster.
20. Kaskan PM, Dean MA, **Nicholas MA,** Mitz AR, Murray EA. (2015) *Gustatory responses in macaque monkeys revealed with fMRI*. 17<sup>th</sup> Annual NIMH DIRP Fellows' Scientific Training Day, poster.
21. **Nicholas MA,** Pafundo DE, Kuhlman SJ. (2015) *Corticocortical feedback-mediated facilitation is cell-type specific and gated by nucleus basalis activity*. Carnegie Mellon Meeting of the Minds Poster Presentation, poster.
22. **Nicholas MA,** Pafundo DE, Kuhlman SJ. (2014) *Top-Down Control of Visual Response in Mouse*. Howard Hughes Medical Institute Seminar Presentation, talk.

## **TECHNICAL SKILLS**

**Computer:** MATLAB, Python, C++, Java, MonkeyLogic, Adobe Illustrator, Adobe Photoshop, ImageJ

**Wet Lab:** Chronic and acute electrophysiology, Histology, Animal care of rodent and non-human primates, Rodent husbandry

**Surgical:** Intracranial Implant, Chronic Electrode Implant, Transcardial perfusion, Intracranial injections, Intracranial window implant

## **PROFESSIONAL MEMBERSHIPS**

Swedish Basal Ganglia Society 2019 - Present

Society for Neuroscience 2016 - Present

## **TEACHING AND MENTORING**

In my time working in the Yttri Lab I have served as a mentor to both graduate and undergraduate students. As a graduate student I have had 7 students report directly to me working on both shared and independent projects.

Special Lecturer, International Youth Neuroscience Association Summer 2024

*Taught material pertaining to learning and memory through primary literature to over 50 high school and undergraduate students from around the world*

Advance Systems Neuroscience Instructor, Carnegie Mellon Spring 2022 - 2024

*Taught graduate students systems neuroscience through primary literature with an additional focus on critical reasoning, discussion and presentation and communication of scientific content, roughly 15 students per semester*

*2023 course evaluation comment: "Mark is so patient and helpful and passionate. I love the discussions during the classes. And the feedback of presentation is always so detailed and encouraging. Love everything about this class."*

*2024 course evaluation comment: "Mark always give us a good feedback after presentation, really appreciate that. He provides us a very good discussion environment, which I never experienced before. This discussion makes me have more understand in each paper, and let me think as a researcher."*

Modern Biology Teaching Assistant, Carnegie Mellon Fall 2020

*Assisted during lectures, held weekly Office Hours, created course content and graded material, roughly 150 students*

Experimental Neuroscience Teaching Assistant, Carnegie Mellon Spring 2015

*Taught undergraduate students both neuroscience methodology and content in a hands on laboratory environment. Taught some lectures, created course content and graded material, roughly 20 students*

## **OUTREACH AND VOLUNTEERING**

Cortico-Basal Ganglia Journal Club, creator, organizer

2018 - Present

*Organize and lead a weekly journal club about motor control, learning and decision making and related topics with members around the Pittsburgh neuroscience community. Along with traditional journal club presentations, I've organized an "In Depth Mini Series" where we discuss 3-4 papers a week for multiple consecutive weeks to explore a given topic in the field. With our transition to virtual presentations, we have also invited external speakers to share their work as well.*

What can we learn from putting electrodes in all parts of the brain? - Science Scavenger Hunt 2022

*Outreach event to teach undergraduate students about research being done in the Department of Biological Science, roughly 40 students*

A unifying hypothesis behind skilled motor actions

2022

*Interviewed by the Carnegie Mellon newspaper, The Tartan, following a departmental talk to share my findings studying how cortex and striatum work together to produce skilled motor actions*

How we use optogenetics to study how the brain controls behavior? - Science Scavenger Hunt 2021

*Outreach event to teach undergraduate students about research being done in the Department of Biological Science, roughly 80 students*

Colloquium Committee, Center for the Neural Basis of Cognition

2021 - 2023

*Organize invited speakers to present to the Pittsburgh neuroscience community*

How do neurons talk to each other and how do we listen? - Science Scavenger Hunt

2019

*Outreach event to teach undergraduate students about research being done in the Department of Biological Science, roughly 60 students*

Department of Biological Science Invited Alumni Career Panel

2019

*Shared how my undergraduate education has helped me in academic research with roughly 100 students*

GFP in the brain: What is a neuron - Science Scavenger Hunt

2014

*Outreach event to teach high school and undergraduate students about histology, microscopy and single neuron morphology, roughly 50 students*

Mellon College of Science Mentor

2013 - 2017

*Mentored a group of 8 undergraduate students starting before their first year and through their time at the university. I held weekly group meeting during their first semester to discuss available resources and then met individually at least once a semester following to help in their progress.*