# Mary D. Cundiff, Ph.D.

COMPUTATIONAL BIOLOGY ENTHUSIAST
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We never stop learning! With over a decade of research experience, I am a biological sciences expert with focuses on systems neurobiology, biochemistry, and immunology. Although my field of interest has continually changed, my passion for understanding biological systems and how to improve them in diseases has remained ever present. The four-year-old kid in me never stopped asking "Why?" and I don't plan on changing that anytime soon. All in all, I am passionate about learning new things, performing extensive data analysis, and disseminating what I've learned to anyone who will listen. What good is learning if you can't share it with the world?

## EDUCATION

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| Ph.D. | Carnegie Mellon University – Pittsburgh, PA<br>Biological Sciences {Neuroscience}<br>Advised by Professor Aryn Gittis, Ph.D. | 2018 – 2024 |
| M.S. | Villanova University<br>Chemistry {Biochemistry}<br>Advised by Professor and Department Chair Daniel Kraut, Ph.D. | 2016 – 2018 |
| B.S. | Centre College – Danville, KY<br>Biology (Chemistry minor)<br>Advised by Associate Professor and Chief Health Professions Advisor, Kerry Pickin Paumi, Ph.D. | 2012 - 2016 |

## WORK EXPERIENCE

**Computational Biology Researcher** | University of Pittsburgh, Pittsburgh, PA ***current position***

- Developed machine learning pipeline to identify common fibrosis signatures across multi-tissue genomic datasets using interpretable ML methods and network analysis
- Built scalable analysis workflows for processing and integrating large-scale immunology datasets in cross-functional research environment
- Applied advanced statistical methods to extract biological insights from high-dimensional gene expression data

**Neurobiology Researcher** | Carnegie Mellon University, Pittsburgh, PA **2018 - 2024**

- Designed and executed end-to-end experimental pipeline to identify neural mechanisms of motor recovery in Parkinson's disease model, resulting in novel therapeutic target discovery
- Developed an elaborate behavioral protocol to investigate the necessity and sufficiency of isolated neural populations, with comparisons across brain-states and utilizing a range of biological techniques.
- Performed complex analyses on behavioral and imaging datasets to validate hypotheses about neural circuit function
- Managed independent research project from experimental design through data collection, analysis, and interpretation

**Biochemistry Researcher** | Villanova University, Villanova, PA **2016 – 2018**

- Applied statistical modeling to yeast experimental data to determine functional requirements of protein degradation pathways relevant to neurodegenerative disease
- Designed experiments testing multiple conditions to isolate key biochemical mechanisms, demonstrating systematic hypothesis-driven approach
- Analyzed complex biochemical datasets to identify critical protein interactions affecting system performance

**Organic Chemistry Researcher** | Centre College, Danville, KY **2014 – 2016**

- Managed experimental project pipeline from molecule design through synthesis and validation testing
- Coordinated multi-stage research workflow optimizing compound synthesis for downstream biochemical screening
- Systematically tested multiple molecular candidates to identify optimal therapeutic compounds

**Managing Editor & Science Writer** | GGR **2021 – present**

- Managed editorial operations for science communication platform covering STEM topics for general audiences
- Coordinated team of 20+ contributing writers and illustrators, establishing editorial standards and publication workflows
- Authored articles translating technical research into accessible content

## SKILLS SUMMARY

**Programming Languages:** Python, R, MATLAB, Linux/Bash, LaTeX, Git/version control
**Machine Learning & Statistics:** Supervised/unsupervised learning, dimensionality reduction, network analysis, statistical modeling, feature engineering
**Bioinformatics & Genomics:** Single-cell RNA-seq analysis (Seurat, Scanpy/AnnData), spatial transcriptomics, differential expression analysis, gene regulatory networks (CellOracle), cell-cell communication (CellChat, COMMOT), NGS data processing
**Data Analysis/Software**: Large-scale data processing, statistical analysis, data visualization (ggplot2, matplotlib, seaborn), pipeline development
**Biology Research:** Project management, immunology bioinformatics, immunohistochemistry, optogenetics, general fluorescence microscopy, viral tracing, immunofluorescence, stereotaxic mouse surgery, fiber photometry, mouse behavioral experiments, protein purification, gene editing, yeast genetics, FPLC, PCR, gel electrophoresis, enzyme kinetics, western blotting, ELISA, synthetic organic chemistry
**Software:** Affinity Designer, Adobe Illustrator, Noldus Ethovision, Microsoft Office Suite, and Google Drive Suite
**Teaching:** Future Faculty Program (CMU), lectures on cellular neuroscience and general biology, TA for neuroscience, biology, genetics, biochemistry, organic chemistry, and general chemistry courses.
**Science Communication:** 2 "Best Poster" Awards, 5+ travel awards, 15+ poster and oral presentations to expert and general audiences, of sizes up to 50+ people; scientific writing and editing, research proposals, peer review, scientific graphical analysis, and time management; I founded a science media collective: **gradsgonerogue.com**
**Outreach/Leadership:** Active committee member, advisor/mentor, teaching assistant, and general member of several groups; Participated in 8+ STEM-related outreach programs
**Website Development:** HTML/CSS, WordPress, Google Sites

## PUBLICATIONS

**Cundiff, M.,** Rahimikollu, J., Liu, C., Hara, M., Sriram, V., Davulvari, H., Natarajan, N., Das, J. (In Prep) TransOT: Interpretable LLMs for finding common signatures of fibrosis across tissues. 2026
Nataranjan, N., Xio, H., Haque, S., **Cundiff, M.**, Das, J., Dutta, P. (In Review) *Spatial transcriptomic analyses of cardiac tissue of patients with ischemic cardiomyopathy using novel machine learning approaches reveal macrophage-mediated fibroblast activation*. 2025
**Cundiff, M.D.**, Buchard, R., Fuchs, T., Mosso, M.B., Barth, A.L., Gittis, A.H. (In Prep) *The Path of Most Persistence: investigating the mechanism for long-lasting motor rescue in a dopamine depletion mouse model.* 2025.
**Cundiff, Mary** (2024). *The Path of Most Persistence: investigating the mechanism of long-lasting motor rescue in a dopamine depletion mouse model.* Carnegie Mellon University. Thesis.
Aristieta, A., Parker, J. E., **Cundiff, M. D.**, Fuchs, T., Lim, B., Rubin, J., & Gittis, A. H. (In Review). *Stimulation of the Medial SNr Promotes Sustained Motor Recovery and Counteracts Parkinsonian Pathophysiology in Dopamine Depleted Mice*. 2024.
Cresti, J. R.*, Manfredonia, A. J.*, Bragança, C. E., Boscia, J. A., Hurley, C. M., **Cundiff, M. D.,** & Kraut, D. A. *Proteasomal conformation controls unfolding ability*. Proceedings of the National Academy of Sciences. 2021. *Equal contribution
**Mary D. Cundiff***, Christina M. Hurley*, Jeremy D. Wong, Eden L. Reichard, Nicholas D. Nassif, Jennifer Brodbelt & Daniel A. Kraut, *Ubiquitin receptors are required for substrate-mediated activation of the proteasome's unfolding ability.* Scientific Reports. 2019. *Equal contribution
**Cundiff, M. D.** (2018). *Ubiquitin Receptors Mediate Proteasomal Processivity* (Order No. 10809787). Available from ProQuest Dissertations & Theses Global. (2079549216).
**Mary D. Cundiff***, Christina M. Hurley*, Jeremy D. Wong, Eden L. Reichard, Nicholas D. Nassif, Jennifer Brodbelt & Daniel A. Kraut, *Ubiquitin receptors are required for substrate-mediated activation of the proteasome's unfolding ability.* BioRxiv. 2019. *Equal contribution

## POSTERS & PRESENTATIONS

**Center for Systems Immunology Retreat:** Fall 2025. Poster Presentation
*Interpretable LLMs for finding common signatures of fibrosis across tissues.* **Mary Cundiff**, Javad Rahimikollu, Hitesh Davuluri, Mika Hara, Varsha Sriram, Niranjana Natarajan, Jishnu Das. Immunology, University of Pittsburgh, Department

of Medicine. Pittsburgh, PA 15213

**Immunology Department Retreat:** Fall 2025. Poster Presentation
*Interpretable LLMs for finding common signatures of fibrosis across tissues.* **Mary Cundiff**, Javad Rahimikollu, Hitesh Davuluri, Mika Hara, Varsha Sriram, Niranjana Natarajan, Jishnu Das. Immunology, University of Pittsburgh, Department of Medicine. Pittsburgh, PA 15213

**Immunology Student/Postdoc Research in Progress Series:** Fall 2025. Oral Presentation
*Interpretable LLMs for finding common signatures of fibrosis across tissues.* **Mary Cundiff**, Javad Rahimikollu, Hitesh Davuluri, Mika Hara, Varsha Sriram, Niranjana Natarajan, Jishnu Das. Immunology, University of Pittsburgh, Department of Medicine. Pittsburgh, PA 15213

**Department of Medicine Research Day:** Spring 2025. Poster Presentation
*GPR155 Regulates Inflammatory Responses in Macrophages.* Varsha Sriram, Mika Hara, **Mary Cundiff**, Jishnu Das, and Niranjana Natarajan. Division of Rheumatology and Clinical Immunology, Department of Medicine, Center for Systems Immunology, Department of Immunology. Pittsburgh 15213

**MWCCS 2024 Semi-Annual EC Meeting**: Fall 2024. Poster Presentation
*Using interpretable machine learning to uncover phenotypic and serological determinants of Covid-19 vaccine response in men living with HIV.* **Mary Cundiff**, Peter Shaucair, Chuck Rinaldo, and Robbie Mailliard. Immunology, University of Pittsburgh, Department of Medicine, Division of Infectious Diseases. Pittsburgh, PA 15213

**Oral PhD Defense** (open to the public): March 2024. Oral Presentation
*The Path of Most Persistence: investigating the mechanism of long-lasting motor rescue in a dopamine depletion mouse model.* **Mary D. Cundiff**, Aryn H. Gittis, Carnegie Mellon Libraries, Mellon University, Pittsburgh, PA 15213

**CMU Three Minute Thesis (3MT) Competition:** Spring 2024. Oral Presentation
*The Path of Most Persistence: investigating the mechanism of long-lasting motor rescue in a dopamine depletion mouse model.* **Mary D. Cundiff,** Aryn H. Gittis. Carnegie Mellon Libraries, Carnegie Mellon University, Pittsburgh, PA 15213

**Society for Neuroscience Meeting (SFN):** November 2023. Poster Presentation
*Isolation of a basal ganglia-receiving brainstem population and its role in motor rescue of a Parkinsonian mouse model.* **Mary D. Cundiff,** Aryn H. Gittis. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA 15213

**Biological Sciences Department Retreat:** September 2023. Poster Presentation
*Isolation of a basal ganglia-receiving brainstem population and its role in motor rescue of a Parkinsonian mouse model.* **Mary D. Cundiff,** Aryn H. Gittis. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA 15213

**International Basal Ganglia Conference (IBAGS):** June 2023. Poster Presentation
*Isolation of a basal ganglia-receiving brainstem population and its role in motor rescue of a Parkinsonian mouse model.* **Mary D. Cundiff,** Aryn H. Gittis. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA 15213

**Center for the Neural Basis of Cognition (CNBC) Retreat:** May 2022. Poster Presentation
*Investigating brainstem nuclei cell populations in a basal ganglia motor rescue model of dopamine depleted mice.* **Mary D. Cundiff,** Dan Albaugh, Aryn H. Gittis. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA 15213

**Gordon Research Conference - Basal Ganglia:** March 2022. Poster Presentation.
*Investigating brainstem nuclei cell populations in a basal ganglia motor rescue model of dopamine depleted mice.* **Mary D. Cundiff,** Dan Albaugh, Aryn H. Gittis. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA 15213

**Center for the Neural Basis of Cognition (CNBC) Brain Bag:** Spring 2020. Presentation.
*Investigating brainstem nuclei cell populations in a basal ganglia motor rescue model of dopamine depleted mice.* **Mary D. Cundiff,** Aryn H. Gittis. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA 15213

**11th Frontier's in Chemistry & Biology Interface Symposium:** May 2018. Poster Presentation.
*Ubiquitin Receptors Mediate Proteasomal Processivity.* **Mary D. Cundiff**, Christina M. Hurley, Jeremy D. Wong, Eden L. Reichard, William J. Dewey, Nicholas D. Nassif & Daniel A. Kraut. Department of Chemistry, Villanova University, Villanova PA 19085

**Sigma Xi CRF Research Day:** April 2018. Poster Presentation.
*Ubiquitin Receptors Mediate Proteasomal Processivity.* **Mary D. Cundiff**, Christina M. Hurley, Jeremy D. Wong, Eden L. Reichard, William J. Dewey, Nicholas D. Nassif & Daniel A. Kraut. Department of Chemistry, Villanova University, Villanova PA 19085

**Protein Society Annual Symposium:** July 2017. Poster Presentation.
*Ubiquitin Receptors Mediate Proteasomal Processivity.* **Mary D. Cundiff**, Eden L. Reichard, William J. Dewey, Nicholas D. Nassif & Daniel A. Kraut. Department of Chemistry, Villanova University, Villanova PA 19085

**American Chemical Society National Meeting:** March 2016. Poster Presentation.
*Synthesis of Peptide-Linked Metal Chelators: Molecular disruptors for amyloid-β aggregation.* **Mary D. Cundiff**, Louis T. Rodgers, Kerry Pickin. Department of Chemistry, Centre College, Danville, PA 40422

**Centre College RICE Symposium:** April 2016. Poster Presentation & Oral Presentation.
*Synthesis of Peptide-Linked Metal Chelators: Molecular disruptors for amyloid-β aggregation.* **Mary D. Cundiff**, Louis T. Rodgers, Kerry Pickin. Department of Chemistry, Centre College, Danville, PA 40422

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## HONORS AND AWARDS

Poster Award Winner: Highest Ranked – Center for Systems Immunology Retreat 2025, University of Pittsburgh.
"Best Poster" Award – Biological Sciences Retreat 2023, Carnegie Mellon University.
Margaret Carver Travel Award, Mellon College of Science – Biological Sciences, Carnegie Mellon University. Society for Neuroscience (SFN), Washington D.C. (2023)
Margaret Carver Travel Award, Mellon College of Science – Biological Sciences, Carnegie Mellon University. International Basal Ganglia Society (IBAGS), Stockholm, Sweden (2023)
Center for the Neural Basis of Cognition Travel Award, Carnegie Mellon University. International Basal Ganglia Society (IBAGS), Stockholm, Sweden (2023)
National Science Foundation Graduate Research Assistantship, Villanova University. (2016-2018)
Conference Travel Funding, Villanova University. Protein Society Annual Symposium, Montreal, Quebec, Canada (2017)

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## SCIENCE COMMUNICATION

**Reviewer/Judge** **Fall 2025**
I reviewed several abstracts and award submissions for the School of Medicine Symposium at the University of Pittsburgh

**Guest Editor** **2025**
As a Guest Editor for JoVE, Prabal Chhibbar and I organized a Methods Collection on Bridging Bench and Bytes: Integrative Approaches to Biological Discovery. We aim to cover hybrid computational/bench protocols, scalable approaches for experimental efficiency and computational methods for understanding high throughput methods.

**Science Writing/Media** **2021 – present**
I started a blog in 2021 that has been updated into a "scientific updates" informal collective media site and newsletter, called GGR (Grads Gone Rogue). At its core, GGR is about curiosity, discovery, and thoughtful conversation. We bring together writers, scientists, and illustrators who are passionate about exploring the wonders of science. Our goal is simple: to spark curiosity, encourage discussion, and celebrate the beauty of scientific exploration.
*Skills: Project Management, Science Writing, Communication, Editing, Illustrating, Publishing, Website Management, Social Media Management*

**Communities & Workshops**
- The CSCCE: community of practice for scientific community engagement managers
- SciCommers: A Science Communcation Collective (Boston University)
- SCERN (Science Communication Education and Research Network) Member: Spring 2025 Workshop Series

**Social Media**
I have had a presence on Instagram since 2011, Facebook since 2008, and recently entered the world of BlueSky (2024). I regularly stay up-to-date on trending topics, fads, and the current state of marketing on social media. I have personal accounts as well as other accounts for GGR.

**Website Management**
I have managed several websites, including a science media site (GGR), my doctoral lab website at CMU, and a personal website.

*Platforms*: WordPress, Google Sites, and Beehive.

## TEACHING EXPERIENCE

**Future Faculty Program**
Eberly Center program aided in preparing PhD students for faculty positions. I completed certificate entailing lesson planning, teaching statements, course design, lecture observations, and teaching seminars.
2023 – 2024
Carnegie Mellon University

**Guest Lecturer,** Cellular Neuroscience, *03362*
Undergraduate Majors Course; I have been invited to cover a few lectures for this course over several semesters.
Instructor: Aryn Gittis, Ph.D.
*2021 – 2024*
Carnegie Mellon University

**Guest Lecturer,** Biochemistry and Molecular Biology, *BMB 500 Senior Seminar*
Undergraduate Senior Seminar; I was invited as a guest lecturer to present and discuss my Ph.D. work at Carnegie Mellon University.
Instructors: January Haile, Ph.D. & Christina Garcia, Ph.D.
*Spring 2023*
Centre College

**Teaching Assistant**, Biological Sciences, *Advanced Cellular Neuroscience*
Undergraduate/Graduate Neuroscience Course; giving lectures, holding review sessions and grading homework/exams.
Instructor: Aryn Gittis, Ph.D.
*2021 – 2023*
Carnegie Mellon University

**Teaching Assistant**, Biological Sciences, *Modern Biology*
Undergraduate Introductory Biology Course; holding review sessions and grading homework/exams.
Instructors: Becki Campanaro, Ph.D. and Antonio-Javier Lopez, Ph.D.
*Fall 2019*
Carnegie Mellon University

**Grader**, Biological Sciences, *Experimental Genetics*
Undergraduate Genetics Lab; grading lab reports and exams.
Instructors: Carrie Doonan, Ph.D. and Emily Drill, Ph.D.
*Fall 2018*
Carnegie Mellon University

**Teaching Assistant**, Chemistry, *Biochemistry Survey*
Undergraduate Non-majors Biochemistry Lab Course.
Instructors: Jennifer Palanchar, Ph.D. and Peter Palanchar, Ph.D.
*Fall 2016*
Villanova University

**Teaching Assistant**, Chemistry, *General Chemistry I & II, Organic Chemistry I & II*
Undergraduate Chemistry Lab Courses.
Instructors: Joe Workman, Ph.D., Kerry Pickin Paumi, Ph.D., and Jennifer Muzyka, Ph.D.
*2014 – 2016*
Centre College

## OUTREACH/LEADERSHIP

**Communications Committee Member (UPitt)**
The University of Pittsburgh Postdoctoral Association (UPPDA); I manage and create content for UPPDA social media outlets, including Instagram, LinkedIn, our website, and our monthly newsletter.
**2025 - present**

**Undergraduate Research Advisor (UPitt)**
I mentor undergraduate students by helping them organize projects, design experiments, as well as build time management and science communication skills.
**2025 - present**
University of Pittsburgh

**Hillman Academy Immunology Program Mentor**
I mentored a high school student through the 7-week program by guiding them through a scRNA-seq analysis of differentially expressed genes in heart failure tissue compared to healthy tissue. I structured our daily 1:1 meetings to discuss the details of the biology, the analysis, and building their communication skills for weekly presentations. My main objective was to ensure they were motivated, engaged and excited about the work.
**Summer 2025**

**Science Fair Judge**, Villa Maria Academy Lower School.
January 2025

Judging of 7th grade students' science fair projects.

**Women in Bio (WIB) Member** **Summer 2022 - present**
WIB is working to support recognized and emerging women leaders in the biosciences industry. Specifically, the MAPS mentoring program aims to create supportive networks and develop professional leadership skills. Pittsburgh, PA

**International Youth Neuroscience Association (IYNA) Volunteer Lecturer** Summer 2023
I participated as a lecturer for the 2023 Intensive Summer Program, giving several lectures for both Neuroscience I and Neuroscience II levels. Remote

**Undergraduate Research Advisor (CMU)** *2022 - 2024*
I mentored several undergraduate students in laboratory research skills. From setting up a question and executing experiments to data analysis and discussing results, I guide students through neurobiology research projects. Carnegie Mellon University

**Action Potential Advising Program (APAP) Advisor** *2021 – 2022*
Simply Neuroscience: virtually connects young neuroscience students with older professional advisors to provide educational guidance and mentorship.

**Center for the Neural Basis of Cognition (CNBC) Committee Member** *2021 – 2022*
Professional Development Committee Carnegie Mellon University
Carnegie Mellon University/University of Pittsburgh collaborative organization.
Organizing networking and career building events for graduate students.

**Teaching Assistant**, Biological Sciences Outreach Program *March 2019*
Using DNA to Solve a Murder Mystery, March 19th, 2019. Carnegie Mellon University
Teaching assistant for high school students performing an ELISA assay.
Funding provided through the Leonard Gelfand Center for Service Learning and Outreach.
Coordinator: Carrie Doonan, Ph.D.

**Science Fair Judge**, St. Mary Magdalen Elementary/Middle School. *January 2018*
Judging of 7th grade students' science fair projects.

**Science Fair Judge**, St. Mary Magdalen Elementary/Middle School. *January 2017*
Judging of 7th grade students' science fair projects.

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