

Alexandra Maria Proca

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EDUCATION

Imperial College London <i>Doctor of Philosophy in Theoretical Neuroscience and Machine Learning; President's Scholar</i>	Oct. 2023 – Present London, UK
University College London <i>Master of Science in Machine Learning with Distinction; Dean's List Laureate</i>	Sept. 2020 – Dec. 2021 London, UK
University of North Carolina at Chapel Hill <i>Bachelor of Science in Computer Science, in Neuroscience with Honors, Minor in Music</i>	Aug. 2016 – May 2020 Chapel Hill, NC

RESEARCH EXPERIENCE

Research Assistant <i>ETH Zürich Department of Computer Science (Lab: Dr. João Sacramento)</i> <ul style="list-style-type: none">Conducted research studying the use of hypernetworks for meta-learning	Jan. 2022 – Jan. 2023 Zürich, CH
Master's Student <i>UCL Department of Computer Science (Lab: Dr. Jun Wang)</i> <ul style="list-style-type: none">Conducted research studying the partial information decomposition of multitask neural networks across varying task settings in supervised and reinforcement learning models	May 2021 – Dec. 2021 London, UK
Research Intern <i>MIT Brain and Cognitive Sciences (Lab: Dr. Tomaso Poggio)</i> <ul style="list-style-type: none">Completed the Massachusetts Institute of Technology Summer Research Program for two summersConducted research adversarially reprogramming recurrent neural networks across task domains	June 2019 – Aug. 2020 Cambridge, MA
Research Assistant <i>UNC Department of Mathematics (Lab: Dr. Peter Mucha)</i> <ul style="list-style-type: none">Conducted statistical research analyzing changes in neural morphology of infant fMRI data	May 2018 – May 2020 Chapel Hill, NC
Research Assistant <i>UNC Department of Psychology and Neuroscience (Lab: Dr. Sylvia Fitting)</i> <ul style="list-style-type: none">Conducted behavioral research in animal models, studying HIV-1 Tat's effects on operant conditioning tasks and how endocannabinoids can be used to protect against assessed behavioral deficits	Jan. 2017 – May 2020 Chapel Hill, NC
Research Intern <i>OSU Department of Computer Science (Lab: Dr. Radu Teodorescu)</i> <ul style="list-style-type: none">Conducted research using Arduino accelerometers to create motion-detection gloves, designed to teach middle and high-school students basic programming skills	May 2015 – Aug. 2015 Columbus, OH

HONORS AND AWARDS

Imperial College London President's PhD Scholarship (Full PhD Tuition & Stipend)	January 2023
UCL Dean's List Laureate: Awarded to Top 5% of Graduating Class	March 2022
UCL Friends and Alumni Association Scholarship (\$20,000)	May 2020
Honors Carolina Laureate	May 2020
Graduated with Honors in Neuroscience from UNC	May 2020
David Bray Peele Memorial Research Award (\$220)	Oct. 2019
Carolina Research Scholar	Jan 2019
Lindquist Undergraduate Research Award (\$350)	Nov. 2018
Office of Undergraduate Research Travel Award (\$300)	Nov. 2018
Psi Chi Psychology Honor Society	March 2018
Honor's Carolina Membership	Sept. 2017
Sigma Alpha Lambda Honor Society	May 2017
The National Society of Collegiate Scholars	May 2017
UNC Dean's List	Dec. 2016 – May 2017

PUBLICATIONS AND THESES

1. *From Lazy to Rich: Exact Learning Dynamics in Deep Linear Networks*. C. Domine*, N. Anguita*, **A.M. Proca**, L. Braun, D. Kunin, P.A.M. Mediano**, A.M. Saxe**. **ArXiv Preprint**, October 2024.
2. *Neural networks with fast and bounded units learn flexible task abstractions*. **A.M. Proca***, J.P. Bauer*, K.J. Sandbrink*, A.M. Saxe, C. Summerfield, A. Hummos. **NeurIPS Spotlight**, December 2024.
3. *Synergistic information supports modality integration and flexible learning in neural networks solving multiple tasks*. **A.M. Proca**, F.E. Rosas, A.I. Luppi, D. Bor, M. Crosby*, P.A.M. Mediano*. **PLoS Computational Biology**, May 2024. <https://arxiv.org/abs/2210.02996>
4. *Discovering modular solutions that generalize compositionally*. S. Schug*, S. Kobayashi*, Y. Akram, M. Wolczyk, **A.M. Proca**, J. Von Oswald, A. Steger, R. Pascanu, J. Sacramento. **ICLR**, May 2024.
5. *Jack of All Trades, or Master of One: Information Decomposition Reveals Distinct Features of Generalizable vs. Specialized Neural Representations*. **A.M. Proca**. Masters Thesis, University College London, London, UK, December 2021. (Supervisors: M. Crosby, P.A.M. Mediano; Advisor: J. Wang)
6. *Establishing a Contextual Fear Conditioning Paradigm for the Tat Transgenic Mouse Model*. **A.M. Proca**. Bachelors Honors Thesis, University of North Carolina at Chapel Hill, NC, USA, May 2020. (Supervisor: I.R. Jacobs, Advisor: S. Fitting) <https://doi.org/10.17615/expe-sc24>
7. *Inhibitory control deficits in Tat transgenic mice using the Go/No-Go task*. I.R. Jacobs, D.J. Hermes, A.G. Antonucci, A.B. Ferguson, K.L. Leggette, N.R. Miseo, **A.M. Proca**, C.B. Russell, C. Manjarres, K. Mackie, A.H. Lichtman, B. Ignatowska-Jankowska, S. Fitting. **Journal of Neuroimmune Pharmacology**. 13, S38-S38 (2018).

CONFERENCE AND WORKSHOP TALKS

1. *Learning context representations in linear networks*. **A.M. Proca**, J. Bauer, K. Sandbrink, A. Hummos. **Junior Scientists Workshop on Recent Advances in Theoretical Neuroscience**, Trieste, Italy, June 2024.
2. *Informational synergy as a link between biological and artificial brains*. P. Mediano, A. Luppi, **A.M. Proca**, F. Rosas, M. Crosby, D. Bor. **Conference on Complex Systems 2022**, Palma de Mallorca, Spain, October 2022.
3. *Linking generalizable intelligence to consciousness via information synergy*. **A.M. Proca**. **Association for Mathematical Consciousness Science: Modelling Consciousness Workshop**, Dorfgastein, Austria, August 2022.
4. *Fast deep learning with a simple model of the prefrontal cortex*. **A.M. Proca**, M. Wolczyk, D. Zhao, S. Kobayashi, S. Schug, J. von Oswald, J. Sacramento. **Sinergia Meeting 2022**, Bern, Switzerland, July 2022.

CONFERENCE AND WORKSHOP POSTER PRESENTATIONS

1. *Learning dynamics in linear recurrent neural networks*. **A.M. Proca**, M. Shanahan, P. Mediano. **Conference on Cognitive Computational Neuroscience**, Boston, Massachusetts, August 2024.
2. *How context representations emerge during training: a linear network perspective*. **A.M. Proca***, K. Sandbrink*, J. Bauer*, A. Hummos. **COSYNE 2024**, Lisbon, Portugal, February 2024.
3. *Synergistic information supports modality integration and flexible learning in neural networks solving multiple tasks*. **A.M. Proca**, F.E. Rosas, A.I. Luppi, D. Bor, M. Crosby, P.A.M. Mediano. **Gatsby Computational Neuroscience Unit Analytical Connectionism Summer School**, London, England, August 2023.

4. *Synergistic information supports modality integration and flexible learning in neural networks solving multiple tasks.* **A.M. Proca**, F.E. Rosas, A.I. Luppi, D. Bor, M. Crosby, P.A.M. Mediano. **Conference on Cognitive Computational Neuroscience**, Oxford, England, August 2023.
5. *Jack of All Trades, or Master of One: Distinct Features Between Generalizable and Specialized Artificial Neural Representations.* **A.M. Proca**, M. Crosby, P. Mediano. **25th Annual Meeting of the Association for the Scientific Study of Consciousness**, Amsterdam, Netherlands, July 2022.
6. *A Picture is Worth 784 Characters: Adversarially Reprogramming a Neural Network.* **A.M. Proca**, A. Banburski, T. Poggio. **34th Annual MIT Summer Research Programs Poster Session**, Cambridge, MA, USA, August 2019.
7. *Time-Dependent Inhibitory Control Deficits in Female Tat transgenic mice in the Go/No-Go Task.* **A.M. Proca**, I.R. Jacobs, D.J. Hermes, A.G. Antonucci, A.B. Ferguson, K.L. Leggette, N.R. Miso, C.B. Russell, C. Manjarres, A. Lichtman, B. Ignatowska-Jankowska, S. Fitting. **48th Annual Meeting of the Society for Neuroscience**, San Diego, CA, USA, November 2018.
8. *Cannabinoid receptor type 1 upregulation of the infralimbic cortex of female Tat transgenic mice following ten months of Tat expression and testing for inhibitory control deficits using the Go/No-Go task.* I.R. Jacobs, D.J. Hermes, A.G. Antonucci, A.B. Ferguson, K.L. Leggette, N.R. Miso, **A.M. Proca**, C.B. Russell, C. Manjarres, K. Mackie, A. Lichtman, B. Ignatowska-Jankowska, S. Fitting. **48th Annual Meeting of the Society for Neuroscience**, San Diego, CA, USA, November 2018.
9. *Time-dependent effects of Tat on Go/No-Go performance.* I.R. Jacobs, D.J. Hermes, A.G. Antonucci, A.B. Ferguson, K.L. Leggette, N.R. Miso, **A.M. Proca**, C.B. Russell, C. Manjarres, S. Fitting. **35th Annual Meeting of the South Eastern Association for Behavior Analysis**, Chattanooga, TN, USA, October 2018.
10. *Inhibitory control deficits in HIV-1 Tat transgenic mice are sex dependent and alter CB1R expression.* A.B. Ferguson, I.R. Jacobs, D.J. Hermes, A.G. Antonucci, K.L. Leggette, N.R. Miso, **A.M. Proca**, C.B. Russell, C. Manjarres, K. Mackie, A.H. Lichtman, B.M. Ignatowska-Jankowska, S. Fitting. **35th Annual Meeting of the South Eastern Association for Behavior Analysis**, Chattanooga, TN, USA, October 2018.
11. *HIV-1 Tat transgenic mice show inhibitory control deficits in the Go/No-Go task.* S. Fitting, I.R. Jacobs, D.J. Hermes, A.G. Antonucci, A.B. Ferguson, K.L. Leggette, N.R. Miso, **A.M. Proca**, C.B. Russell, C. Manjarres, C. Xu, K. Mackie, A.H. Lichtman, B. Ignatowska-Jankowska. **11th Annual Meeting of the Federation of European Neuroscience Societies**, Berlin, Germany, July 2018.
12. *Changes of the endocannabinoid system in HIV-1 Tat transgenic mice.* I.R. Jacobs, C. Xu, D.J. Hermes, A.G. Antonucci, A.B. Ferguson, K.L. Leggette, N.R. Miso, **A.M. Proca**, C.B. Russell, C. Manjarres, C. Xu, M.J. Niphakis, B.F. Cravatt, K. Mackie, A.H. Lichtman, B. Ignatowska-Jankowska, S. Fitting. **International Cannabinoid Research Society**, Leiden, Netherlands, June 2018.

MENTORSHIP

Nicolas Anguita: MEng Computing thesis on *Learning dynamics of linear neural networks*

TEACHING

Graduate Teaching Assistant <i>Computational Neurodynamics</i>	Oct. 2024 – Dec 2024 London, UK
Teaching Assistant <i>Introduction to Research in Network Data Science (Math 190)</i>	Jan. 2019 – May 2019 Chapel Hill, USA

TRAINING AND WORKSHOPS

Junior Scientists Workshop on Recent Advances in Theoretical Neuroscience	June 2024 <i>Trieste, IT</i>
Gatsby Unit Analytical Connectionism Summer School	August 2023 <i>London, UK</i>
Mathematical Consciousness Science: Modelling Consciousness Workshop	August 2022 <i>Dorfgastein, AUT</i>
Sinergia Meeting 2022	July 2022 <i>Bern, CH</i>
UCL & PSL Summer School on Consciousness and Metacognition	June 2021 <i>London, UK</i>
MIT Brains, Minds, and Machines Summer Course	Aug. 2020 <i>Cambridge, USA</i>
University of Nicosia Summer Pre-Med Program	June 2017 – July 2017 <i>Nicosia, CY</i>

LEADERSHIP AND SERVICE

Executive Officer <i>Qualiaheads Consciousness Science Journal Club</i>	Feb. 2022 – Jan. 2023 <i>Zürich, CH</i>
Treasurer <i>Psi Chi Psychology Honor Society</i>	March 2018 – May 2019 <i>Chapel Hill, USA</i>
Executive Officer <i>Carolina Neuroscience Club</i>	Jan. 2018 – May 2020 <i>Chapel Hill, USA</i>
Piano Instructor <i>Musical Empowerment</i>	Sept. 2017 – May 2020 <i>Chapel Hill, USA</i>
Member <i>Women in Computer Science</i>	Sept. 2017 – May 2020 <i>Chapel Hill, USA</i>
Boston Qualifying Team <i>UNC Marathon Team</i>	Sept. 2016 – May 2020 <i>Chapel Hill, USA</i>

SKILLS

Python, Pytorch, JAX, Java, Latex, C/C++

LANGUAGES

English: Native
Romanian: Conversational
French: Elementary
Spanish: Elementary