

# Alexandra Maria Proca

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## EDUCATION

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

## RESEARCH EXPERIENCE

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

## HONORS AND AWARDS

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

1. *Learning dynamics in linear recurrent neural networks.* **A.M. Proca**, C.C.J. Dominé, M. Shanahan, P.A.M. Mediano. **ICML Oral**, 2025.
2. *From Lazy to Rich: Exact Learning Dynamics in Deep Linear Networks.* C.C.J. Dominé\*, N. Anguita\*, **A.M. Proca**, L. Braun, D. Kunin, P.A.M. Mediano\*\*, A.M. Saxe\*\*. **ICLR**, May 2025.
3. *Flexible task abstractions emerge in linear networks with fast and bounded units.* K. Sandbrink\*, J.P. Bauer\*, **A.M. Proca**\*, A.M. Saxe, C. Summerfield, A. Hummos\*. **NeurIPS Spotlight**, December 2024.
4. *Training the next generation of NeuroAI researchers: Trainees' perspectives.* A. Luppi\*, J. Achterberg\*, S. Schmidgall, I. Poyraz Bilgin, P. Herholz, M. Sprang, B. Fockter, A. Siyoon Ham, S. Thorat, R. Ziaei, F. Milisav, **A.M. Proca**, H. M. Tolle, L. Suárez, P. Scotti, H. M. Gellersen. **Nature Communications**, October 2024.
5. *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.
6. *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.
7. *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)
8. *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)
9. *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).

\*,\*\* Equal contribution

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## CONFERENCE AND WORKSHOP TALKS

1. *Learning dynamics in linear recurrent neural networks.* **A.M. Proca**, C.C.J. Dominé, M. Shanahan, P.A.M. Mediano. Oral presentation at **ICML**, Vancouver, Canada, July 2025.
2. *Learning dynamics in linear recurrent neural networks.* **A.M. Proca**. Invited talk at **COSYNE Workshop on "Causal perturbation based approaches to uncovering neural dynamics"**, Mont Tremblant, Canada, March 2025.
3. *Learning context representations in linear networks.* **A.M. Proca**\*, J.P. Bauer\*, K. Sandbrink\*, A. Hummos. **Junior Scientists Workshop on Recent Advances in Theoretical Neuroscience**, Trieste, Italy, June 2024.
4. *Linking generalizable intelligence to consciousness via information synergy.* **A.M. Proca**. **Association for Mathematical Consciousness Science: Modelling Consciousness Workshop**, Dorfgastein, Austria, August 2022.
5. *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**, Bern, Switzerland, July 2022.

1. *Learning dynamics in linear recurrent neural networks.* **A.M. Proca**, C.C.J. Dominé, M. Shanahan, P.A.M. Mediano. **UK Neural Computation**, London, England, July 2025.
2. *Learning dynamics in linear recurrent neural networks.* **A.M. Proca**, M. Shanahan, P. Mediano. **Conference on Cognitive Computational Neuroscience (CCN)**, Boston, Massachusetts, August 2024.
3. *How context representations emerge during training: a linear network perspective.* **A.M. Proca\***, K. Sandbrink\*, J. Bauer\*, A. Hummos. **COSYNE**, Lisbon, Portugal, February 2024.
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. **Analytical Connectionism Summer School**, London, England, August 2023.
5. *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. **CCN**, Oxford, England, August 2023.
6. *Jack of All Trades, or Master of One: Distinct Features Between Generalizable and Specialized Artificial Neural Representations.* **A.M. Proca**, M. Crosby, P. Mediano. **Association for the Scientific Study of Consciousness (ASSC)**, Amsterdam, Netherlands, July 2022.
7. *A Picture is Worth 784 Characters: Adversarially Reprogramming a Neural Network.* **A.M. Proca**, A. Banburski, T. Poggio. **MIT Summer Research Programs Poster Session**, Cambridge, MA, USA, August 2019.
8. *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. Miseso, C.B. Russell, C. Manjarres, A. Lichtman, B. Ignatowska-Jankowska, S. Fitting. **Society for Neuroscience**, San Diego, CA, USA, November 2018.
9. *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. Miseso, **A.M. Proca**, C.B. Russell, C. Manjarres, K. Mackie, A. Lichtman, B. Ignatowska-Jankowska, S. Fitting. **Society for Neuroscience**, San Diego, CA, USA, November 2018.
10. *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. Miseso, **A.M. Proca**, C.B. Russell, C. Manjarres, S. Fitting. **South Eastern Association for Behavior Analysis**, Chattanooga, TN, USA, October 2018.
11. *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. Miseso, **A.M. Proca**, C.B. Russell, C. Manjarres, K. Mackie, A.H. Lichtman, B.M. Ignatowska-Jankowska, S. Fitting. **South Eastern Association for Behavior Analysis**, Chattanooga, TN, USA, October 2018.
12. *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. Miseso, **A.M. Proca**, C.B. Russell, C. Manjarres, C. Xu, K. Mackie, A.H. Lichtman, B. Ignatowska-Jankowska. **Federation of European Neuroscience Societies**, Berlin, Germany, July 2018.
13. *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. Miseso, **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.

## SUPERVISION

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Pratyaksh Sharma: MEng Computing thesis on *Analyzing the computational role of complex representations in RNNs*

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

## TEACHING

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**Graduate Teaching Assistant** Oct. 2024 – Dec 2024  
*Computational Neurodynamics* London, UK

**Undergraduate Teaching Assistant** Jan. 2019 – May 2019  
*Introduction to Research in Network Data Science* Chapel Hill, USA

## REVIEWING

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International Conference on Machine Learning (ICML) 2025

Conference on Cognitive Computational Neuroscience (CCN) 2023, 2024

## TRAINING AND WORKSHOPS

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**Junior Scientists Workshop on Recent Advances in Theoretical Neuroscience** June 2024  
Trieste, IT

**Gatsby Unit Analytical Connectionism Summer School** August 2023  
London, UK

**Mathematical Consciousness Science: Modelling Consciousness Workshop** August 2022  
Dorfgastein, AUT

**Sinergia Meeting 2022** July 2022  
Bern, CH

**UCL & PSL Summer School on Consciousness and Metacognition** June 2021  
London, UK

**MIT Brains, Minds, and Machines Summer Course** Aug. 2020  
Cambridge, USA

**University of Nicosia Summer Pre-Med Program** June 2017 – July 2017  
Nicosia, CY

## OUTREACH

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**Guest lecturer for Imperial Computing Undergraduate Society (DoCSoc)** 2025  
*Lecture on mechanistic interpretability* London, UK

**Guest speaker for Girls Who Code at Harriton High School** 2024  
Bryn Mawr, PA

**Graduate student panelist for UNC Neuroscience majors** 2021  
Chapel Hill, NC

## EXTRACURRICULAR AND SERVICE

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**Member** Sept. 2024 – Present  
*Mechanistic Interpretability Journal Club* London, UK

**Organizer** Feb. 2022 – Jan. 2023  
*Qualiaheads Consciousness Science Journal Club* Zürich, CH

**Treasurer** March 2018 – May 2019  
*Psi Chi Psychology Honor Society* Chapel Hill, USA

**Executive Officer** Jan. 2018 – May 2020  
*Carolina Neuroscience Club* Chapel Hill, USA

**Piano Instructor***Musical Empowerment*

Sept. 2017 – May 2020

*Chapel Hill, USA***Member***Women in Computer Science*

Sept. 2017 – May 2020

*Chapel Hill, USA***Boston Qualifying Team***UNC Marathon Team*

Sept. 2016 – May 2020

*Chapel Hill, USA***Swim Coach***Worthington Special Olympics*

Sept. 2014 – Aug. 2016

*Columbus, USA***SKILLS**

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

**LANGUAGES**

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