N Alex Cayco Gajic

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Education

University of Washington, Seattle, Washington, USA
Ph.D. (2015), M.S. (2012) in **Applied Mathematics** (Supervisor: Eric Shea-Brown)
Coordinated neuronal activity: Mechanistic origins and impact on stimulus coding

California Institute of Technology, Pasadena, California, USA
B.S. (2009) in **Applied & Computational Mathematics** with Honour

Academic and research positions

Primary appointments

2025 -	**Professor** *(equivalent to Associate Professor)* Laboratoire de Neurosciences Cognitives & Computationnelles Département d'Etudes Cognitives École Normale Supérieure *Paris, France*
2019 - 2024	**Junior professor** *(equivalent to Assistant Professor)* Laboratoire de Neurosciences Cognitives & Computationnelles Département d'Etudes Cognitives École Normale Supérieure, *Paris, France*
2015 - 2019	**Postdoctoral research associate** (Supervisor: Angus Silver) Department of Neuroscience, Physiology, & Pharmacology University College London*, London, UK*

Secondary appointments

Since 2025	Interdisciplinary Fellow of the **Paris Artificial Intelligence Research Institute** (PRAIRIE)
Since 2020	Affiliated researcher at the **Center for Quantitative Biology** (Qbio), ENS-PSL

Grants awarded

As Principal Investigator

ERC Consolidator 2024 (€ 2 million). *Dynamics underlying learning in complex environments.*

ANR JCJC 2020 (€ 220 thousand). *Probing cerebello-cortical motor learning via recurrent neural networks.*

As Co-Investigator

ANR PRC 2024 (€ 550 thousand). *Distributed cerebello-cortical learning in locomotor adaptation. Coordinated by Michael Graupner (Université Paris Cité, Coordinator).*

ANR PRC 2021. (€ 750 thousand). *Contribution of somatic and dendritic targeting cerebellar interneurons to temporal coding of sensory context. With David DiGregorio (Institut Pasteur, Coordinator), Boris Gutkin (ENS), Clément Lena (ENS).*

As Named Participant (no allocated funds)

BBSRC International Partnering Awards Plus on AI for Bioscience 2023. (£ 230 thousand). *Inferring the evolution of functional connectivity over learning in large-scale neural recordings using low-tensor-rank recurrent neural networks. With Angus Chadwick (University of Edinburgh, Coordinator), Matt Perich (Université de Montréal).*

AAP Emergence 2024 (€ 23 thousand). *Unravelling animal behaviour through decoding of non-invasive, continuous measurements. Coordinated by Michael Graupner (Université Paris Cité).*

Honors and awards

Major	**FENS Kavli Scholar**, FENS Kavli Network of Excellence (2023-2028)
	NSF Graduate Research Fellow (2011-2014)
Minor	ICA Fellow, Intercontinental Academia on Intelligence and AI (2021-2022)
	Wan Fellow, University of Washington (2010-2011)
	ARCS Scholar, ARCS Foundation (2009-2012)
	Boeing Fellow, University of Washington (2009-2010)
	Richter Scholar, Caltech (2007)
	San Pietro Scholar, Caltech (2005-2009)

Publications and preprints

** co-first authorship, † co-last authorship*

1. Pellegrino A*, Stein H*, **Cayco Gajic NA**. (2024). Dimensionality reduction beyond neural subspaces with slice tensor component analysis. Nature Neuroscience 27, 1199-1210. [DOI]
2. Todd H, **Cayco Gajic NA†**, B Gutkin†. (2024) The role of gap junctions and clustered connectivity in emergent synchronisation patterns of inhibitory neuronal networks. In revision. [arXiv]
3. Pellegrino A, **Cayco Gajic NA†**, Chadwick A†. (2023). Low tensor rank learning of neural dynamics. Advances in Neural Information Processing Systems 37. [DOI]
4. Gurnani H, **Cayco Gajic NA**. (2023). Signatures of task learning in neural representations. Current Opinion in Neurobiology 83, 102759. [DOI]
5. Andrianarivelo A, Stein H, Gabillet J, Batifol C, Jalil A, **Cayco Gajic NA**, Graupner M. (2023). Cerebellar interneuron activity is triggered by reach endpoint during learning of a complex locomotor task. In revision. [bioRxiv]
6. Hart B et al. (2022). Neuromatch Academy: a 3-week, online summer school in computational neuroscience. Journal of Open Source Education 5 (49). [DOI]
7. Lanore F*, **Cayco Gajic NA***, Gurnani H, Coyle D, Silver RA (2021). Cerebellar granule cell axons support high dimensional representations. Nature Neuroscience 24 (8), 1142-1150. [DOI]
8. **Cayco Gajic NA**, Zylberberg J (2021). Good decisions require more than information. Nature Neuroscience 24 (7), 903-904. [DOI]
9. **Cayco Gajic NA**, Durand S, Buice M, Iyer R, Reid C, Zylberberg J†, Shea-Brown E† (2019). Transformation of population code from dLGN to V1 facilitates linear decoding. Preprint on bioRxiv. [DOI]
10. **Cayco Gajic NA**, Silver RA (2019) Re-evaluating circuit mechanisms underlying pattern separation. Neuron 101, 584-602. [DOI]
11. Gleeson P et al. (2019). Open Source Brain: a collaborative resource for visualizing, analyzing, simulating and developing standardized models of neurons and circuits. Neuron 103, 1-17. [DOI]
12. **Cayco Gajic NA**, Sweeney Y (2018) Delving deep into crossmodal integration. The Journal of Neuroscience 38, 6442-6444. [DOI]
13. **Cayco Gajic NA**, Zylberberg J, Shea-Brown E (2018) A maximum entropy model for fitting higher-order interactions. Entropy 20, 489. [DOI]
14. **Cayco Gajic NA**, Clopath C, Silver RA (2017) Sparse synaptic activity is required for decorrelation and pattern separation in feedforward networks. Nature Communications 8, 1116. [DOI]
15. **Cayco Gajic NA**, Zylberberg J, Shea-Brown E (2015) Triplet correlations among similarly tuned cells impact population coding. Frontiers in Computational Neuroscience 9, 57. [DOI]
16. **Cayco Gajic NA**, Shea-Brown E (2013). Neutral stability, rate propagation, and critical branching in feedforward networks. Neural Computation 25, 1768-1806. [DOI]

Invited Talks

03/25 **Cosyne workshop** on Learning, Fast and Slow. *Montreal, Canada.*

03/25 **Kavli Institute for Systems Neuroscience.** External seminar series. *Trondheim, Norway.*

01/25 **University College London.** NeuroAI Talk Series. *London, UK (Virtual).*

01/25 **Cambridge University.** Computational and Biological Learning Lab Seminar. *Cambridge, UK.*

01/25 **Centre de Recerca Matematica.** BARCCSYN Seminar. *Barcelona, Spain.*

09/24 Plenary speaker at **Bernstein Conference**. *Frankfurt, Germany.*

09/24 **Bernstein Conference workshop** on Bridging RNNs and data: Hypothesis-testing of network dynamics against neural recordings. *Frankfurt, Germany.*

09/24 **Qbio-Pasteur minisymposium** on Information processing in biology. *Paris, France.*

09/24 **Fondation de Treilles workshop** on Cerebellum and learning. *Tourtour, France.*

06/24 **International Centre for Theoretical Physics workshop** on Recent Advances in Theoretical Neuroscience. *Trieste, Italy.*

05/24 **SIAM Applied Linear Algebra minisymposium** on Low-rank numerical patterns of dynamical systems and neural networks. *Paris, France.*

04/24 **Oxford University**. Oxford Neurotheory Forum. *Oxford, UK.*

04/24 **Institut de l'Audition.** External seminar series. *Paris, France.*

03/24 **Università Bocconi**. Department of Computing Sciences. Neuroscience and Machine Learning Seminar. *Milan, Italy.*

02/24 **Cosyne workshop** on The Geometry & dynamics of learning: Bridging analytical and experimental insights into neural representations. *Lisbon, Portugal.*

02/24 **Cosyne workshop** on I can't believe it's not better! *Lisbon, Portugal (recording online).*

01/24 **Van Vreeswijk Theoretical Neuroscience Seminar**. *World-wide (Virtual, recording online).*

01/24 **European Neuroscience Institute Göttingen**. *Göttingen, Germany.*

10/23 Institute of Neuroinformatics. **ETH Zurich and University of Zurich.** *Zurich, Switzerland.*

09/23 **Bernstein Conference workshop.** Symmetry, invariance, & neural representations. *Berlin, Germany.*

04/23 **Janelia Research Campus workshop.** Causes and implications of representational drift. *Ashburn, VA, USA.*

03/23 **Columbia University**. Zuckerman Institute & Grossman Center for the Statistics of Mind. *New York, NY, USA.*

02/23 **École de Physique des Houches workshop** on Recent advances in understanding artificial and biological neural networks. *Les Houches, France.*

09/22 **Bernstein Conference**. Workshop on Information processing through correlated and coordinated responses. *Berlin, Germany.*

08/22 **Okinawa Institute of Science and Technology**. *Okinawa, Japan.*

08/22 **University of Nagoya workshop** on Robot and Artificial Intelligence. *Nagoya, Japan.*

07/22 **Plasticity, Learning and the Sensory Brain**. *Paris, France.*

07/22 **Japanese Neuroscience Society symposium** on High-Dimensional Neural Data: the Experimental and Theoretical Frontiers. *Okinawa, Japan (Hybrid).*

03/22 **French Cerebellum Club Conference**. *Bordeaux, France.*

01/22 **Allen Institute for Brain Science workshop** on Neurotheory. *Seattle, WA, USA (Virtual).*

01/22 **Banff International Research Station workshop** on Dynamical Principles of Biological and Artificial Neural Networks. *Banff, Canada (Virtual).*

09/21 **Bernstein Conference** workshop on The Geometry of Neural Activity: Low-Dimensional Dynamics and High-Dimensional Representations. *Germany (Virtual).*

03/21 **San Jose State University**. Mathematics and Statistics Colloquium. *San Jose, CA, USA (Virtual)*

10/20 **Pacific North West AccelNet** Branch retreat symposium. *Seattle, WA, USA (Virtual)*

07/20 **Mathematical Sciences Research Institute**. MSRI-Up Colloquium. *Berkeley, CA, USA (Virtual)*

06/20 **University of Bristol**. Neural Dynamics Forum. *Bristol, UK (Virtual).*

05/20 **IDIBAPS**. BARCCSYN Seminar. *Barcelona, Spain (Virtual).*

02/20 **Karolinska Institutet**. Neurosession. *Stockholm, Sweden.*

02/19 **École Normale Supérieure**. New Ideas in Computational Neuroscience symposium. *Paris, France.*

12/16 **University College London**. NPP Shorts seminar series. *London, UK.*

10/15 **Oxford University**. Industrial and Applied Mathematics Seminar. *Oxford, UK.*

07/15 **Oxford University**. Oxford Neurotheory Forum. *Oxford, UK.*

05/14 **Centre de Recerca Matematica**. Computational Neurosciences Seminar. *Barcelona, Spain.*

09/12 **Computational Neuroscience Connection conference**. *Seattle, WA, USA.*

Contributed Talks

09/19 **Neural Coding, Computation and Dynamics conference**. *Capbreton, France.*

07/19 **Cerebellum Gordon Research Conference**. *Les Diablerets, Switzerland.*

03/19 **Cosyne. Main meeting**. *Lisbon, Portugal.*

10/18 **Champalimaud Research Symposium** on Quantitative approaches to behaviour & neural systems. *Lisbon, Portugal.*

05/13 **SIAM Conference on Applications of Dynamical Systems minisymposium** on Emergent Dynamics of Large Neural Networks. *Snowbird, UT, USA.*

01/09 **AMS-MAA Joint Mathematics Conference**. *Washington, D.C., USA.*

01/08 **AMS-MAA Joint Mathematics Conference**. *San Diego, CA, USA.*

Research mentorship

Postdoctoral fellows

- **Heike Stein,** EMBO fellow, ENS (2020 - 2024; now permanent researcher at CNRS & Sorbonne University). *Large-scale population analysis of cerebellar data, in collaboration with Michael Graupner (Université de Paris, SPPIN). Ecole Normale Supérieure.*

Doctoral students

- **Leonard Agueci**. *Probing cerebello-cortical motor learning via recurrent neural networks. Ecole Normale Supérieure.*
- **Hélène Todd**. *Modelling rapid synchronisation in electrically coupled interneurons. Co-supervision with Boris Gutkin. Ecole Normale Supérieure.*
- **Mattia Della Vecchia**, Qlife bourse de thèse. *A reinforcement learning model of the cerebellum. Ecole Normale Supérieure.*
- **Hugo Ninou**. *Hebbian learning dynamics. Co-supervision with Jonathan Kadmon, Hebrew University of Jerusalem. Ecole Normale Supérieure.*

Master's students

- **Shaurya Goyal** (2025). *Learning dynamics in feedback control RNNs. M1 Cogmaster student.*
- **Sasha Lanine** (2024 - 2025). *Non-normal dynamics and neural sequences. M2 Cogmastser student.*
- **Jeanne Sentenac** (2023). *Cerebellar microcircuitry and nonrandom feature selection. M1 Cogmaster student.*
- **Paul Marcin** (2022). *Tensor analysis of large-scale mouse V1 recordings during perceptual decision making. M1 Cogmaster student.*
- **Caroline Bouat** (2022). *Hierarchical behavioural modelling of hindlimb coordination in mouse locomotion. M1 Cogmaster student.*

- **Sepehr Rasouli** (2021 - 2022). *Decoding behavioural information in mouse visual cortex. M2 Cogmaster student.*
- **Arthur Pellegrino** (2020 - 2021). *Extension of Tensor Component Analysis for identifying low-dimensional latent representations in multi-region neural recordings. M1 Cogmaster student.*
- **Louis McDougall-Vigier** (2020 - 2021). *Reinterpretation of classic cerebellar cortical circuitry using reinforcement learning. M2 student at ENS de Paris-Saclay.*
- **Olivier Fernandez** (2019 - 2020). *Modelling temporal basis function dynamics in an integrate-and-fire model of the cerebellar cortex. M2 student at ENS de Lyon.*
- **Antonin Verdier** (2019). *Linking neural activity data to behaviour. (TINS project, co-supervised with Michael Graupner). M2 student at Ecole Normal Supérieure.*

Undergraduate students

- **Lucas Goupil** (2019 - 2020). *Application of machine learning methods to studying cerebellar learning. L3 student at Université de Paris.*
- **Otso Pelkonen** (2015 - 2016). *Information processing in feedforward networks with heterogeneous properties. Application of evolutionary algorithms to find optimal network connectivities in a model of the cerebellar cortex. BS candidate at University College London..*
- **Yoni Browning** (2012 - 2013). *Plasticity in feedforward networks. BS candidate at the University of Washington.*
- **UW STEM Bridge Program** for incoming underrepresented engineering and science students (2011). *Research leader for a team of five students through two weeks of intensive instruction and group research. Project: combining Hebbian STDP and homeostatic plasticity to self-organise rate propagation in feedforward networks.*

Teaching experience

Institutional teaching

As **course instructor**	**Mathematical tools for data science, machine learning, and statistical modelling** (2024). *Focused course on mathematical foundations of advanced statistical and analysis methods for high-dimensional data. Graduate level, 30 students.* [syllabus]
	Cognitive models and AI. (2021 - 2024). *Multidisciplinary course introducing modelling across cognitive science, from biophysics of single neurons to collective decision-making, with a focus on recent advances in neuroAI. Graduate level, 60 students.* [syllabus]
As **course coordinator**	**Data science DIY** (2019 - 2024). *A self-paced course for students to gain data science skills by working through Datacamp tutorials and projects. Graduate level, 50 students.*
As **guest lecturer**	**Theoretical Neuroscience** (2020 - present). *Every year I deliver a 1 hour guest lecture on neural network models of cerebellar learning. Graduate level, 20 students.*
As **tutor**	**The Cellular Basis of Brain Function** practical modelling sessions (2016, 2017). Department of Neuroscience, Physiology and Pharmacology, University College London. *Undergraduate level, 25 students.*
As **teaching assistant**	**Introduction to Dynamical Systems** (2011). Department of Applied Mathematics, University of Washington. *Advanced undergraduate and graduate level, 40 students.*

International summer & winter schools

As **keynote speaker**	**Cajal Course in Machine Learning for Neuroscience** (2023). *Champalimaud Centre for the Unknown, Lisbon, Portugal.*
	Cajal Course in Computational Neuroscience (2022, 2024). *Champalimaud Centre for the Unknown, Lisbon, Portugal.*
	Okinawa Computational Neuroscience Course (2024). *Okinawa Institute for Science and Technology, Okinawa, Japan.*
As **lecturer**	**Qlife Quantitative Biology Winter School** on Learning and Plasticity in Neuronal Networks (2024). *Université Paris Sciences et Lettres, Paris, France.*
	Neuromatch Academy (2020). *MOOC course for computational neuroscience with the goal of making graduate-level summer workshops more internationally accessible during the pandemic.* https://www.neuromatchacademy.org/

As **tutor** — **Computational and Cognitive Neuroscience Summer School** (2018). *Cold Spring Harbor Asia. Suzhou, China.*

Professional service

Workshops and seminars

As **co-organizer**

Neural Networking Night (2024). *Monthly neuroscience seminar series and social networking event for the Parisian neuroscience community, hosted at an iconic student bar in the Latin quarter. Paris, France. https://neuralnetworkingnight.github.io/*

Cosyne workshop (2024). *The Geometry & Dynamics of Learning: Bridging Analytical and Experimental Insights into Neural Representations. Two-day workshop. Portugal, Lisbon.*

Paris & Île-de-France NeuroTheory Symposium (2022, 2024). *One-day symposium focusing on computational and systems neuroscience with competitively chosen abstracts for contributed talks. Paris, France. https://pints.fr*

Statistical Physics of Neural Systems and Signals (2022). *Three-day workshop at the Scuola Internazionale Superiore di Studi Avanzati (SISSA), Trieste, Italy.*

ICA4 Fellows Seminar series (2021-2022). *Monthly seminar series. Virtual.*

Seminar on Computational and Systems Neuroscience (2019 – 2020). *Bi-weekly local lunch seminar series. Ecole Normale Supérieure, Paris, France.*

SIAM Conference on the Life Sciences microsymposium (2011). *Half-day workshop on the Impact of architecture on the complexity of neuronal dynamics. Snowbird, UT, USA.*

As **session chair** — **Cosyne main meeting** (2024). *Portugal, Lisbon.*

As **discussion leader** — **Gordon Research Symposium Cerebellum** (2019). *Les Diablerets, Switzerland.*

Program committee — **Cosyne** (2024, 2025) and **Bernstein Conference** (2025).

Journals and funding agencies

Referee for Cosyne, Nature, Nature Neuroscience, Nature Communications, Cell Reports, eLife, Trends in Cognitive Science, PLOS Computational Biology, PLOS Biology, PLOS One, Journal of Physiology, Neural Computation, Frontiers in Cellular Neuroscience, Entropy, European Journal of Applied Mathematics, Biological Cybernetics.

Guest editor for PLOS Computational Biology (2020).

Expert reviewer for Wellcome Discovery Award.

Ph.D. committees

Examiner for Allan Mancoo (Ecole Normale Supérieure; defended 2021), Allan Montarras (Ecole Normale Supérieure; defended 2022), Diogo Duarte (Champalimaud Centre for the Unknown; defended 2024).

Thesis committee member for Sophie Bodenes (Ecole Normale Supérieure), Mathieu Pham Van Cang, (Institut de la Vision), Hanoi Ivan Guillermo Montiel (Institut Pasteur), Astrid Nilsson (Institut Pasteur), Flavien Feral (Ecole Normale Supérieure), Simone Azeglio (Sorbonne and Ecole Normale Supérieure), Célia Jonas (Ecole Normale Supérieure).

Institutional service

CFM-ENS Data Science Chair (2024 -) *Co-organization of the Data Science Colloquium at the ENS and selection for the Laplace Junior Professor Chair in Data Science.*

Specialty Director of Cognitive modelling, neurotheory and AI (2024 -) *for the Master in Cognitive Science at the Ecole Normal Supérieure.*

Selection Internationale Sciences (2019 -), *institution-wide selection committee for a prestigious fellowship at the master's level, Ecole Normal Supérieure.*

PhD Selection Committee (2019 -) *Département d'Etudes Cognitives, Ecole Normal Supérieure.*

Equality and Diversity Steering Committee (2019 - 2023), *Département d'Etudes Cognitives, Ecole Normal Supérieure.*

Member of the **Groupe de Travail** to design a new Master in Cognitive Science (2023) *Ecole Normal Supérieure.*

Member of the **Conseils Pédagogiques** of the École Doctorale Cerveau, Cognition, Comportement (from 2022) and the Department of Cognitive Science at the Ecole Normal Supérieure (from 2019)

Co-founder, **SysNeuroBeers** (2022 - 2024), *Ecole Normale Supérieure and Université Paris Cité.*

Organiser, **Computational Neuroscience Journal Club** (2012 – 2013), *University of Washington.*

Founder and organiser, **Computational Neuroscience Happy Hour** (2013 – 2015), *University of Washington.*

Science outreach

Events at local schools

Ambassadrice Déclics (2023). *I participated in an outreach event in which I spoke with small groups of lycéens (equivalent to high school students) about the working life of a scientific researcher.*

Volunteer at **Math Fair** (2010, 2011, 2012, 2014), *Math Fair is a UW graduate student run program culminating in a day of outreach events at local elementary schools to engage children in math and its applications.*

Volunteer at the **Julia Robinson Mathematics Festival** (2012), *a day of math outreach and problem solving aimed at inspiring a love of mathematics in 4th-12th grade students.*

Guest contributor on podcasts

Creativity For All (2021). *I was interviewed to discuss creativity in neuroscience and in scientific research more broadly. Listen online.*

Free Range with Michael Livermore (2021), *a podcast on law, science, philosophy, and AI. I was interviewed to discuss my research interests in neuroscience and embodied cognition. Listen online.*

Unsupervised Thinking (2018 - 2019), *a podcast in which academics discuss neuroscience and artificial intelligence research and theories for a non-specialist audience. I participated in discussions on predictive coding, working memory, the cerebellum, the brain and evolution, neuroscience methods, and the field of neuroscience more broadly. Listen online.*