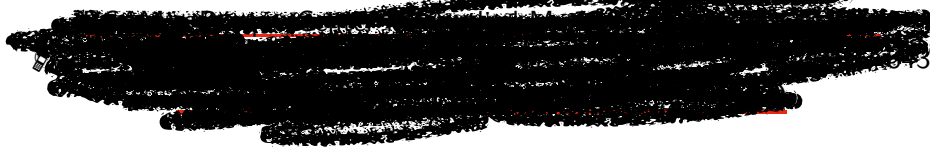


Maurizio De Pittà | Curriculum Vitae



I use theoretical models of biochemical pathways and cellular networks to investigate how the brain processes and learns information. My current work focuses on mechanisms of learning and memory, from synapse to network levels, in the context of aging and Alzheimer's disease. My core expertise is in the biophysics of neuron-glia interactions, with emphasis on intracellular calcium signaling, neurotransmission, protein trafficking, and inflammation, in collaboration with experimental groups, physicists and engineers in Europe and the United States.

Keywords: computational biology, theoretical neuroscience, neuron-glia interactions, calcium signaling, synaptic plasticity and learning, memory, neurodegeneration, Alzheimer's disease, age-related dementia, reaction-diffusion media, spiking cell networks, stochastic processes, mean-field theory, nonlinear systems theory.

Education

- 2008–2013 **Ph.D.**, *Tel Aviv University*, Israel.
Physics and Electronics
- 1998–2007 **M.Sci.**, *University of Pisa*, Italy, 110/110.
Electronics and Bioengineering

Academic Employment

- 08/2018–present **Junior Leader (3-year appointment)**, *BCAM – Basque Center for Applied Mathematics, Bilbao, Spain*, MCEN Group – Mathematical, Computational and Experimental Neuroscience, *Main research topic*: Computational modeling of reactive astrogliosis in the etiology of Alzheimer's disease and age-related dementia.
- 06/2014–06/2018 **Postdoctoral research (*shared appointment)**, *INRIA Rhône-Alpes, Lyon, France*, Project-Team BEAGLE, Computational Biology Group, *Main research topic*: Multi-scale computational modeling of neuron-glia interactions.
- 06/2014–12/2016 **Postdoctoral research (*shared appointment)**, *The University of Chicago, Chicago, IL, USA*, Group of Nicolas Brunel, *Main research topic*: Mean-field theory and spiking neuron-glia networks.
- 06/2013–05/2014 **Postdoctoral research**, *INRIA Rhône-Alpes, Lyon, France*, Project-Team BEAGLE, Computational Biology Group, *Main research topic*: Compartmental modeling of spatiotemporal calcium dynamics in astroglial cells.

Grants

- 2020–2024 **Principal Investigator, ASTROTECH European Training Network**, *European Commission*, ID:MSCA-ITN-ETN-956325, €250.904,88.
- 2018–2021 **‘Junior Leader’ Research Fellowship**, *‘la Caixa’ Banking Foundation*, ID: LCF-BQ-LI18-11630006, €298.500,00.
- 2014–2017 **Marie Skłodowska-Curie International Outgoing Fellowship**, *European Commission*, ID: FP7-PEOPLE-2012-IOF-331486, €268.761,10.
- 2013–2014 **Alain Bensoussan Fellowship**, *European Research Council for Computer Science and Mathematics*, ID: FP7-COFUND-ABCDE-240616, €37.558,00.

Contracts

- 2020–2021 **Principal Investigator**, *Analysis and Modeling of Stochastic Calcium Signaling in Astrocytes*, Fulbright Postdoctoral Fellowship awarded to Dr. Evan Cresswell-Clay, Fulbright Commission (Spanish branch), ID: 887108371.
- 2019–2021 **Scientist**, *RED de INVESTIGACIÓN “Aplicaciones Terapeuticas de la Neurociencia De Sistemas en Enfermedades del Sistema Nervioso Central”*, [tr. “Therapeutic Applications of Systems Neuroscience in the Pathology of the Central Nervous System”], ID: RED2018-102491-T.
- 2019–2021 **Staff Scientist**, *Project I+D+i “Desarrollo de Nuevas Metodologías Matemáticas y Experimentales para Controlar la Actividad Neuronal y Diseñar Códigos Especiales Espacio-Temporales”*, [tr. “Development of New Mathematical and Experimental Technology to Control Neuronal Activity and Design Special Spatio-temporal Codes”], ID: RTI2018-093860-B-C21.
- 2012–2014 **Postdoc Researcher**, *“Astrocytic regulation of neural network activity”*, High Council for Scientific and Technological Cooperation between France and Israel.

Publications

In Press

- [1] **M. De Pittà**. Neuron–glia interactions. In D. Jaeger and R. Jung, editors, *Encyclopedia of Computational Neuroscience*. Springer, 2020.

Peer-Reviewed Articles

- [1] K. V. Kastanenka, R. Moreno-Bote, **M. De Pittà**, G. Perea, A. Eraso-Pichot, R. Masgrau, K. E. Poskanzer, and E. Galea. A roadmap to integrate astrocytes into Systems Neuroscience. *Glia*, pages 1–22, 2019.
- [2] **M. De Pittà** and N. Brunel. Modulation of synaptic plasticity by glutamatergic gliotransmission: A modeling study. *Neural Plasticity*, 7607924, 2016.
- [3] **M. De Pittà**, N. Brunel, and A. Volterra. Astrocytes: orchestrating synaptic plasticity? *Neuroscience*, 323:43–61, 2015.
- [4] G. Wallach, J. Lallouette, N. Herzog, **M. De Pittà**, E. Ben-Jacob, H. Berry, and Y. Hanein.

Glutamate-mediated astrocytic filtering of neuronal activity. *PLoS Comput. Biol.*, 10(12):e1003964, 2014.

- [5] J. Lallouette, **M. De Pittà**, E. Ben-Jacob, and H. Berry. Sparse short-distance connections enhance calcium wave propagation in a 3D model of astrocyte networks. *Frontiers Comput. Neurosci.*, 8:45, 2014.
- [6] **M. De Pittà**, V. Volman, H. Berry, V. Parpura, N. Liaudet, A. Volterra, and E. Ben-Jacob. Computational quest for understanding the role of astrocyte signaling in synaptic transmission and plasticity. *Frontiers Comput. Neurosci.*, 6:98, 2013.
- [7] L. Meshulam, R. Galron, S. Kanner, **M. De Pittà**, P. Bonifazi, M. Goldin, D. Frenkel, E. Ben-Jacob, and A. Barzilai. The role of the neuro-astro-vascular unit in the etiology of *Ataxia-telangiectasia*. *Frontiers Pharmacol.*, 3:157, 2012.
- [8] T. Fellin, J. M. Ellenbogen, **M. De Pittà**, E. Ben-Jacob, and M. Halassa. Astrocyte regulation of sleep circuits: experimental and modeling perspectives. *Frontiers Comput. Neurosci.*, 6(65):65, 2012.
- [9] **M. De Pittà**, V. Volman, H. Berry, and E. Ben-Jacob. A tale of two stories: astrocyte regulation of synaptic depression and facilitation. *PLoS Comput. Biol.*, 7(12):e1002293, 2011. (*Recommended by Faculty of 1000 Biology*).
- [10] M. Goldberg, **M. De Pittà**, V. Volman, H. Berry, and E. Ben-Jacob. Nonlinear gap junctions enable long-distance propagation of pulsating calcium waves in astrocyte networks. *PLoS Comput. Biol.*, 6(8):e1000909, 2010.
- [11] **M. De Pittà**, V. Volman, H. Levine, and E. Ben-Jacob. Multimodal encoding in a simplified model of intracellular calcium signaling. *Cognitive Proc.*, 10(S1):55–70, 2009.
- [12] **M. De Pittà**, M. Goldberg, V. Volman, H. Berry, and E. Ben-Jacob. Glutamate-dependent intracellular calcium and IP₃ oscillating and pulsating dynamics in astrocytes. *J. Biol. Phys.*, 35:383–411, 2009. (*Recommended by Faculty of 1000 Biology*).
- [13] **M. De Pittà**, V. Volman, H. Levine, G. Pioggia, D. De Rossi, and E. Ben-Jacob. Coexistence of amplitude and frequency modulations in intracellular calcium dynamics. *Physics Rev. E*, 77(3):030903(R), 2008.

Books

- [1] **De Pittà, M.** and H. Berry. *Computational Glioscience*. Springer, 2019.

Contributed Book Chapters

- [1] M. Stimberg, D. F. M. Goodman, R. Brette, and **De Pittà, M.** Modeling neuron–glia interactions with the *Brian 2* simulator. In M. De Pittà and H. Berry, editors, *Computational Glioscience*, chapter 18, pages 471–505. Springer, 2019.
- [2] V. Matrosov, S. Gordleeva, N. Boldyreva, E. Ben-Jacob, V. Kazantsev, and **De Pittà, M.** Emergence of regular and complex calcium oscillations by inositol 1,4,5-trisphosphate signaling in astrocytes. In M. De Pittà and H. Berry, editors, *Computational Glioscience*, chapter 6, pages 151–176. Springer, 2019.

- [3] J. Lallouette, **De Pittà, M.**, and H. Berry. Astrocyte networks and intercellular calcium propagation. In M. De Pittà and H. Berry, editors, *Computational Glioscience*, chapter 7, pages 177–210. Springer, 2019.
- [4] M. Goldin, **De Pittà, M.**, M. Llarena, and G. Diez. Neurofisiología [tr. Neurophysiology]. In J. C. Arango-Asprilla and L. Olabarriete Landa, editors, *Daño Cerebral [tr. Brain Damage]*, chapter 2, pages 1–19. Manual Moderno, 2019.
- [5] **De Pittà, M.** and H. Berry. A neuron–glial perspective for Computational Neuroscience. In M. De Pittà and H. Berry, editors, *Computational Glioscience*, chapter 1, pages 3–35. Springer, 2019.
- [6] **De Pittà, M.**, E. Ben-Jacob, and H. Berry. G protein-coupled receptor-mediated calcium signaling in astrocytes. In M. De Pittà and H. Berry, editors, *Computational Glioscience*, chapter 5, pages 115–150. Springer, 2019.
- [7] **De Pittà, M.** Gliotransmitter exocytosis and its consequences on synaptic transmission. In M. De Pittà and H. Berry, editors, *Computational Glioscience*, chapter 10, pages 245–287. Springer, 2019.

Invited Lectures

- 10/29/2020 **Neuron-glial theory of working memory**, *KCNHub Colloquium (online)*, Krembil Brain Institute, Toronto, Canada.
- 07/15/2020 **Reverse engineering neuron-glial interactions: An overarching approach from Cellular Biophysics to Medicine**, *Symposium on “Glial interfaces: Technology & methods to uncover the 4D glial role in brain function & dysfunction”*, 12th FENS Forum of Neuroscience, Glasgow, UK.
- 07/07/2020 **Bistability emerges from neuron-glial interactions in the healthy and diseased brain**, *Krembil Brain Institute Seminar Series*, Job Talk (online), Toronto, Canada.
- 01/19/2020 **Mean-field analysis of history-dependent, stochastic activity in neuron-glial networks**, *Workshop on PDEs: Modelling, Analysis and Numerical Simulation*, Dept. of Applied Mathematics, University of Granada, Spain.
- 06/19/2019 **Bistability of synaptic release in the presence of gliotransmission**, *Scientific Computing Colloquium*, Dept. of Scientific Computing, Florida State University, Tallahassee, FL, USA.
- 04/25/2019 **Theory of gliotransmission: Controversies vs. consequences on synaptic transmission and plasticity**, *Colloquium*, Dept. of Biological Sciences, State University of New York, Albany, NY, USA.
- 03/11/2019 **Emergence of multistability by neuron-glial interactions**, *Dynamics Seminars*, University of Exeter, Exeter, UK.
- 02/13/2019 **Multistable neuron-glial networks in health and disease**, *5th Workshop on Quantitative Biomedicine for Health and Disease*, Basque Center for Applied Mathematics, Bilbao, Spain.
- 09/18/2017 **Functional implications of gliotransmission**, *Colloquium*, Achucarro–The Basque Center for Neuroscience, Leioa, Spain.

- 09/07/2017 **Conditions for the observation of regulation of synaptic transmission by gliotransmitters**, *Symposium on "Neuron-glia cross-talk in synaptic physiology and its implications in synaptic pathology"*, Annual Meeting of the Italian Physiology Society, Pavia, Italy.
- 02/27/2017 **Functional implications of gliotransmission**, *Workshop on "Advances in experimental and theoretical studies of astrocyte-neuron interactions"*, COSYNE'17 Meeting, Snowbird, UT, USA.
- 01/25/2016 **Beyond trophism: Information processing emerging from astrocyte-synapse coupling**, *Colloquium*, Laboratory for Integrative Neurosciences, University of Illinois, Chicago, IL, USA.
- 05/08/2014 **Do astrocytes compute? Making the point on neuron-glia interactions**, *IMBB Seminar*, FORTH–Foundation for Research and Technology Hellas, Heraklion, Greece.
- 03/25/2014 **Do astrocytes compute? Making the point on neuron-glia interactions**, *PhD Seminars*, Bernstein Center, University of Freiburg, Freiburg, Germany.
- 05/11/2012 **The challenge of the astrocyte signaling network**, *Neuroscience Seminar*, Collège de France, Paris, France.
- 02/08/2012 **Theory and modelling of astrocyte regulation of synaptic plasticity**, *Colloquium*, Institute of Applied Physics, Russian Academy of Science, Nizhni Novgorod, Russia.

Conferences

Contributed Talks

- 09/05/2019 **Synapse-glial interactions in regulation of network dysfunction underpinning cognitive impairment**, *Workshop on "New horizons on brain disorders: from clinical diagnosis to cell therapy and the impact on neuron-glial circuits structure and dynamics"*, 18th Meeting of the Spanish Society for Neurosciences, Santiago de Compostela, Spain.
- 07/19/2019 **Multistable neuron-glial networks in health and disease**, *Workshop on "Recent advances in modelling complex oscillations in the brain's physiopathology"*, ICIAM 2019, Valencia, Spain.
- 07/09/2017 **Conditions for the observation of regulation of synaptic transmission by gliotransmitters**, *Workshop on "Mathematical and computational approaches to the 'Big Data' challenge in neuron-glia interactions"*, 13th Euroglia Meeting, Edinburgh, UK.
- 07/31/2014 **An astrocyte hypothesis for persistent activity**, *Workshop on "Computational methods and modelling of astrocyte physiology and neuron-glia interactions"*, Annual Meeting of the Organization of Computational Neuroscience, Quebec City, Canada.

Poster Abstracts

- [1] G. Bonifazi, C. Luchena, A. Gaminde-Blasco, C. Ortiz-Sanz, E. Capetillo-Zarate, C. Matute, E. Alberdi, and **M. De Pittà**. *In silico* modeling of a tripartite synapse shows A β -dependent

astrocytic GLT1 trafficking as a reliable marker of excitotoxicity in preclinical stages of Alzheimer's disease. In *12th FENS Meeting*, page ID: 4240, Glasgow, UK, 2020. Forum of the European Societies of Neuroscience.

- [2] C. Vivar-Rios, T. A. Pham, C. Vonesch, E. Bindocci, B. L. Lind, T. Kikuchi, **M. De Pittà**, and A. Volterra. PIPES: A module-based pipeline framework to accelerate reproducible data analysis in astrocyte research. In *Neuroinformatics Abstracts*, page P58, University of Warsaw, Poland, 2019. International Neuroinformatics Coordinating Facility.
- [3] P. Bonifazi, S. Kanner, M. Goldin, R. Galron, E. Ben-Jacob, A. Barzilai, and **M. De Pittà**. Astrocytes restore connectivity and synchronization in dysfunctional cerebellar networks. In *BMC Neuroscience*, page P150, Barcelona, Spain, 2019. Organization for Computational Neurosciences.
- [4] G. Bonifazi, T. Quintela-López, C. Ortiz-Sanz, A. Botta, M. Gaminde-Blasco, A. Pérez-Samartín, C. Matute, E. Alberdi, and **M. De Pittà**. Homeostatic mechanism of myelination for age-dependent variations of axonal conductance speed in the pathophysiology of Alzheimer's disease. In *BMC Neuroscience*, page P89, Barcelona, Spain, 2019. Organization for Computational Neurosciences.
- [5] G. Bonifazi, A. Ferrero, C. Luchena, E. Capetillo-Zarate, A. Pérez-Samartín, C. Matute, S. Rodrigues, E. Alberdi, and **M. De Pittà**. Determinants of trafficking of glutamate transporters on perisynaptic astrocytic processes during preclinical stages of Alzheimers disease. In *14th EU-ROGLIA*, page T05.098C, Porto, Portugal, 2019. Network Glia.
- [6] **M. De Pittà**, H. Berry, and N. Brunel. Characterization of neural firing in the presence of astrocyte-synapse signaling. In *BMC Neuroscience*, volume 17, page P194, Jeju, Republic of Korea, 2016. Organization for Computational Neurosciences.
- [7] **M. De Pittà**, H. Berry, and N. Brunel. Persistent delay activity in a neuron-glia network model. In *Neuroscience Meeting Planner*, volume 94.17, page BB62, Chicago, IL, 2015. Society for Neuroscience, Online.
- [8] J. Lallouette, **M. De Pittà**, E. Ben-Jacob, and H. Berry. The topology of astrocyte networks controls the propagation of intercellular calcium waves. In *BMC Neuroscience*, volume 15, page P205, Québec City, Canada, 2014. Organization for Computational Neurosciences.
- [9] **M. De Pittà**, J. Lallouette, N. Liaudet, A. Volterra, E. Ben-Jacob, and H. Berry. Modelling of Ca^{2+} dynamics in astrocytic processes. In *9th FENS Forum*, Milan, Italy, 2014. Federation of the European Neuroscience Societies.
- [10] **M. De Pittà**, H. Berry, and E. Ben-Jacob. Mechanism for astrocyte-mediated persistent activity. In *Neuroscience Meeting Planner*, volume 217.05, page D13, Washington, DC, USA, 2014. Society for Neuroscience, Online.
- [11] **M. De Pittà**, E. Ben-Jacob, and H. Berry. Astrocytic theory of working memory. In *BMC Neuroscience*, volume 15, page P206, Québec City, Canada, 2014. Organization for Computational Neurosciences.
- [12] **M. De Pittà**, V. Volman, H. Berry, N. Liaudet, A. Volterra, and E. Ben-Jacob. A compartmental approach to modeling of calcium events in astrocyte processes. In *Neuroscience*

Meeting Planner, volume 541.07, page E4, New Orleans, LA, USA, 2012. Society for Neuroscience, Online.

- [13] **M. De Pittà**, H. Berry, and E. Ben-Jacob. Theory and modeling of astrocyte modulation of synaptic release. In *21st Annual Meeting of the Israeli Society for Neuroscience*, Eilat, Israel, 2012. Israeli Society for Neuroscience.
- [14] M. Goldberg, **M. De Pittà**, V. Volman, H. Berry, and E. Ben-Jacob. On the determinants of calcium wave propagation distance in astrocyte networks: Nonlinear gap junctions and oscillatory modes. In *Cinquième Conférence Plénière Française de Neurosciences Computationnelles, NEUROCOMP'10*, Lyon, France, 2010. French Consortium for Computational Neurosciences.
- [15] H. Berry, M. Goldberg, **M. De Pittà**, V. Volman, and E. Ben-Jacob. On the determinants of calcium wave propagation distance in astrocyte networks: Nonlinear gap junctions and oscillatory modes. In *Neuroscience Meeting Planner*, volume 552.22, page I2, San Diego, CA, USA, 2010. Society for Neuroscience, Online.

STEM Teaching Training

- 2015–2016 **Trainee**, *Mentor training for postdocs*, myCHOICE–Chicago Options in Career Empowerment, The University of Chicago, IL, USA.
20-hour course
- 2015 **Trainee**, *STEM Teaching Workshop*, The University of Chicago, IL, USA.
1-day workshop

Teaching

- 2010–2011 **Teaching Assistant**, *From Genome to Brain*, Module on Nonlinear Dynamics, Faculty of Life Science, Tel Aviv University, Israel.
Undergraduate and Graduate class. Spring Semester for two consecutive years
- Spring 2008 **Teaching Assistant**, *Mathematical Biology*, Module on Calcium Signalling, University of Pisa, Italy.
Graduate class

Mentoring

- José Angel Ornella Rodríguez **MSc student**, *Parametric fitting and dimensionality reduction of artificial neuron models for the study of cerebellar networks*, co-supervised with Alicia Nieto Reyes, Department of Mathematics, University of Cantabria, Santander, Spain.
Started: 01/2020
- Giulio Bonifazi **PhD student**, *Computational modeling and data mining of early biomarkers of Alzheimer's disease*, co-supervised with Elena Alberdi (Achucarro), Basque Center of Applied Mathematics (BCAM) and Achucarro – The Basque Center for Neuroscience, Spain.
Started: 01/2019

Carlos Vivar Rios **PhD student**, *Characterization and simulation of spatiotemporal calcium signals in fine astrocytic processes*, co-supervised with Andrea Volterra, University of Lausanne, Switzerland.
Started: 10/2018

Additional Academic Training

- 08/2009 **Fellow**, *Methods in Computational Neuroscience*, Marine Biological Labs, Woods Hole, MA, USA.
- 07/2005 **Scholar**, *Neural network models of perception, action and embodied knowledge*, Summer School, Dept. of Psychology, University of Bologna, Bologna, Italy.

Other Academic Activities

- Reviewer Physical Review Letters, Physical Review E, PLoS Computational Biology, Nature Scientific Reports, Neural Computation, Neurocomputing, Biological Cybernetics, Frontiers in Computational Neuroscience, Frontiers in Synaptic Neuroscience, Frontiers in Cellular Neuroscience, Journal of Theoretical Biology, Journal of Mathematical Neuroscience, Journal of Computational Neuroscience, IEEE Transactions on Artificial Neural Networks and Learning Systems, IEEE Transactions on Circuits and Systems.
- Grant Reviewer British Biotechnology and Biological Sciences Research Council (BBSRC, since 2013); Polish National Science Center (NCN, since 2019); Air Force Office of Scientific Research (AFOSR, since 2019).
- Co-organizer Workshop on “Multi-disciplinary approaches to quantify and model calcium signaling in nervous systems and beyond” (Melbourne, Australia, 2020); Workshop on “New horizons on brain disorders: from clinical diagnosis to cell therapy and the impact on neuron-glia circuits’ structure and dynamics” (Santiago de Compostela, Spain, 2019); Workshop on “Recent advances in modeling complex oscillations in the brain’s physiopathology” (Valencia, Spain, 2019); Workshops on “Modeling of Neuron-Glia interactions” (Edinburgh, UK, 2017; Quebec City, Canada, 2014; Pisa, Italy, 2007); University of Chicago Neuroscience Postdoc Seminars (2014–2016).
- Speaker “Einstein’s brain: Where is the Genius?” Forward Chicago Outreach Initiative (Chicago Culture Center), “Young Investigators between East and West” Outreach Initiative (Institute for Italian Culture in Israel).

Collaborators (for the past 24 months)

- Spain Paolo Bonifazi (BioCruces Hospital); Carlos Matute and Elena Alberdi (Achucarro, Basque Center for Neuroscience); Elena Galea (Universitat Autònoma de Barcelona), Fernando García-Moreno (Achucarro, Basque Center for Neuroscience).
- Europe Andrea Volterra (University of Lausanne, Switzerland); Giovanni Pioggia (RIMED–National Research Council, Italy).
- Middle East Ari Barzilai (Tel Aviv University, Israel).

North America Nicolas Brunel (Duke University, NC); Gordon Erlebacher (Florida State University, FL).

Selected Media Coverage

- [1] C. Tomé López. How to integrate astrocytes into Systems' Neuroscience – *Mapping Ignorance Science Blog*. Online, April 2019.
- [2] American Friends of Tel Aviv University. Star-shaped glial cells act as the brain's 'motherboard' – *ScienceDaily*. Online, March 2013.
- [3] V. Murelli. Il regista del cervello [*tr.* The brain's filmmaker]. *Le Scienze*, 525:14–15, 2012.
- [4] V. Murelli. Cellule gliali: Una centrale di controllo per le sinapsi [*tr.* Glial cells: A control hub for synapses] – *Le Scienze*. Online, January 2012.
- [5] American Friends of Tel Aviv University. Brain's connective cells are much more than glue: Glia cells also regulate learning and memory – *ScienceDaily*. Online, January 2012.