Carmen Varela, Ph.D.

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Picower Institute for Learning & Memory
Center for Brains, Minds and Machines
Massachusetts Institute of Technology
43, Vassar Street, 46-5233

ACADEMIC APPOINTMENTS

Psychology Department, Florida Atlantic University **2019**
Assistant Professor

MIT, Cambridge, MA.
Research Scientist, NARSAD young investigator **2012-2018**

EDUCATION

MIT, Cambridge, MA.
Post-Doctoral Associate. Advisor: Matthew A. Wilson **2010-2012**
Post-Doctoral Fellow. Advisor: Matthew A. Wilson **2008-2010**
The University of Chicago, IL.
Ph.D. Computational Neuroscience. Advisor: S. Murray Sherman **2002-2008**
University Pablo de Olavide, Seville, Spain.
M.S. Neuroscience. Advisor: Javier Cudeiro **1999-2001**
University of A Coruña, Spain.
B.S. Biology. Highest GPA across regional schools. **1995-1999**
University of A Coruña, Spain.
B. in Physical Therapy. **1992-1995**

RESEARCH TOPICS AND EXPERTISE

POST-DOCTORAL & RESEARCH SCIENTIST

- *Topic*: **Thalamo-Neocortico-Hippocampal Interactions (systems level)**
- Validated a preparation to record units and local field potentials simultaneously from three functionally related areas (midline thalamus, mPFC, CA1) in behaving rats. Demonstrated functional and anatomical contributions of cells in the midline thalamus to the coordination between hippocampus and neocortex thought to underlie sleep-dependent memory consolidation.
- *Methods*: behaving rodent electrophysiology, quantitative methods, behavioral testing, optogenetics, pharmacogenetics, anatomical tracing.
- Partly funded through a NARSAD Young Investigator Award and a Caja Madrid Foundation fellowship. Results from this project were also the basis for NIH and additional private funding.

PH.D. THESIS

- *Title*: '**Functional Differences between First and Higher Order Thalamic Nuclei: Effects of Modulatory Systems and Response Properties**'.
- Demonstrated that cells in primary sensory and associative nuclei of the thalamus are differentially affected by sleep-related neuromodulators (acetylcholine, serotonin), suggesting heterogeneous state-dependent functional channels in thalamocortical associative networks.

- *Methods*: in vitro (slice) electrophysiology and pharmacology.
- Partly funded through a fellowship from the Pedro Barrié de la Maza Foundation.
- *Outcomes*: 5 publications (1 review, 1 book chapter).

PRE-DOCTORAL

New York University, NY. Advisor: Bernardo Rudy. Visiting student, **Sep 2001-Dec 2001**

- *Topic*: **Function of potassium channels in thalamic relay cells**. *Techniques*: in vitro (slice) electrophysiology.

University of A Coruña, Spain. Advisor: Javier Cudeiro. Master's student, **Sep 1999-Sep 2001**

- *Topic*: **The role of corticothalamic feedback in dLGN visual responses.** *Techniques*: in vivo electrophysiology, anesthetized cat.

University of Quilmes, Argentina. Advisor: Diego Golombek. Visiting student, **Jul 1999-Sep 1999**

- *Topic*: **Circadian enzymatic activity in the suprachiasmatic nucleus.** *Techniques*: biochemical assays.

University of A Coruña, Spain. Undergraduate research assistant

- *Techniques*: in vivo electrophysiology, anesthetized cat. **Sep 1998-Jun 1999**
- *Techniques*: Histological methods (sectioning, staining, immunohistochemistry). **Sep 1997-Jun 1998**

PUBLICATIONS AND MANUSCRIPTS IN PREPARATION

- **Varela C,** Wilson MA. **Thalamic contribution to the sleep neocortico-hippocampal dialogue.** In preparation.
- Penagos H, **Varela C**, Wilson MA. **Oscillations, neural computations and learning during wake and sleep**. *Current Opinion in Neurobiology* 2017 (May 29; 44:193-201).
- **Varela C**, Weiss S, Meyer RM, Biedenkapp JC, Halassa MM, Goosens KA, Wilson MA, Bendor D. **Tracking the time-dependent role of the hippocampus in memory recall using DREADDs**. *PLoS One*. 2016 May 4;11(5):e0154374).
- Wilson MA, **Varela C***, Remondes M.* **Phase organization of network computations**. *Curr Opin Neurobiol. 2015* Apr; 31:250-3. *Equal contribution
- Duan A, **Varela C**, Zhang Y, Shen Y, Xiong L, Wilson MA, Lisman J. **The causal role of abnormal delta oscillations in producing working memory deficits; relevance to schizophrenia**. *Biol Psychiatry. 2015* Jun 15; 77(12):1098-1107.
- **Varela C. Thalamic neuromodulation and its implications for executive networks**. *Front. Neural Circuits. 2014* Jun 24. 8:69.
- **Varela C**, Kumar S, Yang JY, Wilson MA. **Anatomical substrates for direct interactions between hippocampus, medial prefrontal cortex and the thalamic nucleus reuniens**. *Brain Structure & Function 2014* May; 219, no. 3: 911–29.
- **Varela C. The gating of neocortical information by modulators**. *J Neurophysiol. 2013* Mar; 109(5):1229-32.
- **Varela C,** Llano DA, Theyel BB. **An introduction to in vitro slice approaches for the study of neuronal circuitry**. Chapter 6, in "Neuronal Network Analysis", "Neuromethods *Series*", *Springer, 2012*.
- **Varela C,** Sherman SM. **Differences in response to serotonergic activation between first and higher order thalamic nuclei**. *Cereb Cortex. 2009* Aug; 19(8):1776-86.
- **Varela C,** Sherman SM. **Differences in response to muscarinic activation between first and higher order thalamic relays**. *J Neurophysiol. 2007* Dec; 98(6):3538-47.
- Lam YW, Cox CL, **Varela C**, Sherman SM. **Morphological correlates of triadic circuitry in the lateral geniculate nucleus of cats and rats**. *J Neurophysiol. 2005* Feb; 93(2):748-57.
- Rivadulla C, Martínez LM, **Varela C**, Cudeiro J. **Completing the corticofugal loop: a visual role for the corticogeniculate type I metabotropic glutamate receptor**. *J Neurosci. 2002* Apr 1; 22(7):2956-62.

INVITED TALKS

Gladstone Institutes, UCSF. San Francisco, CA. **April 2018**
- "Thalamic Contribution to Neocortico-Hippocampal Interactions during Sleep"

Florida Atlantic University. Boca Raton, FL. **March 2018**
- "Contribution of the Midline Thalamus to Neocortico-Hippocampal Interactions during Sleep"

University of Wisconsin. Madison, WI. **July 2017**
- "Contribution of the Midline Thalamus to Neocortico-Hippocampal Interactions during Sleep"

Annual Biomedical Research Conference for Minority Students (ABRCMS) **November 2016**
- "Multidisciplinarity in Systems Neuroscience"

University of Barcelona, Spain **July 2016**
- "Thalamic Contribution to Sleep Neocortico-Hippocampal Interactions"

Brown University. Providence, RI. **May 2016**
- "Thalamic Contribution to Sleep Neocortico-Hippocampal Interactions"

University of Illinois at Urbana-Champaign, IL. **October 2015**
- "Sleep Thalamo-Neocortico-Hippocampal Interactions"

University of Connecticut. Storrs, CT. **December 2014**
- "Thalamo-Cortico-Hippocampal Interactions and Memory Consolidation"

University of Coimbra, Portugal. **March 2014**
- "Disruption of Hippocampal Function Using Pharmacogenetics"

CONFERENCE PRESENTATIONS

ORAL

Hippocampus Spring Conference. Taormina, Italy. **June, 2017**
- "Thalamic Contribution to Neocortico-Hippocampal Interactions during Sleep"

Brains on Brains. Fundraising symposium, MIT. **May, 2017**
- "Science of Education"

COSYNE. ~5% abstracts selected for oral presentation **February, 2017**
- "Thalamic Contribution to Neocortico-Hippocampal Interactions during Sleep"

Janelia Research Campus. Ashburn, VA. **April 2015**
- "Sleep thalamo-neocortico-hippocampal Interactions"

POSTERS

- **Varela C**, Wilson MA. Thalamic contribution to CA1-mPFC interactions during sleep. Society for Neuroscience Meeting, Washington DC, 2017.
- **Varela C**, Wilson MA. Sleep thalamo-cortico-hippocampal interactions. Thalamus and corticothalamic interactions conference. Janelia. April 26-29, 2015.
- **Varela C**, Weiss S, Meyer R, Halassa M, Biedenkapp J, Goosens K-A, Wilson MA, Bendor DA. Pharmacogenetic disruption of hippocampal function. Society for Neuroscience Meeting, San Diego, 2013.
- **Varela C***, Bendor D*, Halassa MM, Biedenkapp JC, Meyer RM, Kuo E, Goosens KA, Wilson MA. Reversible pharmacogenetic inactivation of the hippocampus using DREADDs. Poster presentation at the FENS Forum of neuroscience, Barcelona, 2012. * Equal contribution
- Bendor D*, **Varela C***, Weiss S, Halassa MM, Biedenkapp JC, Meyer RM, Goosens KA, Wilson MA. Tracking the hippocampus-dependence of a contextual fear memory using pharmacogenetics. Poster presentation at the Society for Neuroscience Meeting, and talk at the 7th Brain Research Conference on Optogenetics and Pharmacogenetics in Neuronal Function and Dysfunction, New Orleans, 2012. * Equal contribution

- **Varela C**, Yang JY, Kumar S, Wilson MA. Interactions between the midline thalamus, medial prefrontal cortex and dorsal CA1 in the rat. Society for Neuroscience Meeting, Washington DC, 2011.
- **Varela C**, Sherman SM. Spike-frequency adaptation in higher order thalamic relays: modulation by muscarinic receptors. Society for Neuroscience, Washington DC, 2005.
- **Varela C**, Sherman SM. A further difference between first and higher order thalamic relay: response to cholinergic input. Society for Neuroscience, San Diego, 2004.
- **Varela C**, Sherman SM. A further difference between first and higher order thalamic relay: response to cholinergic input. Symposium 'Cortical Function: A view from the thalamus'. Madison, Wisconsin; September 12th-14th 2004.
- Lam Y-W, **Varela C**, Sherman SM. Morphological and physiological correlates of cells of rat dLGN". Society for Neuroscience, New Orleans, 2003.
- **Varela C**, Rivadulla C, Martínez LM, Cudeiro J. Stimulus dependent modulation of LGN activity by cortically activated metabotropic glutamate receptors. Society for Neuroscience, San Diego, 2001.
- Rivadulla C, Martínez LM, **Varela C**, Cudeiro J. Efecto del bloqueo de las aferencias corticales en la respuesta de las células del núcleo geniculado lateral: estímulos estáticos. IX Spanish Society for Neuroscience, 2001.
- Martínez LM, Rivadulla C, **Varela C**, Cudeiro J. Efecto del bloqueo de las aferencias corticales en la respuesta de las células del núcleo geniculado lateral: estímulos dinámicos. IX Spanish Society for Neuroscience, 2001.
- Ferreyra G, Murad A, **Varela C**, Golombek D. Cyclic nucleotides, kinases and phosphorylation: some intimacy in the hamster suprachiasmatic nulcei. V Latin American Symposium of Chronobiology. Buenos Aires, 1999.

TEACHING

MIT

- "The Neuroscience Business". Reading-discussion group. Organizer. **January 2016**
- CBMM Annual Quantitative Methods Workshop. Lecture: "Intro to Systems Neuroscience". **January 2016, 2017**
- Systems Neuroscience (graduate level). Lecture: "Organization and Function of Thalamic Networks". **October 2015**
- CBMM Summer Workshop for High School Science Teachers. Guest lecture: "Network Mechanisms of Behavior. The View from Electrophysiology". **July 2015**
- "So You Wanna be a Scientist". Organizer. **January 2015**
- "Building Your Own Neuroscience Lab". Co-organizer. **January 2012**

Boston University

- Course faculty, BE-710 Neuroplasticity and Perceptual Learning. Lectures on: "A Systems Neuroscience Perspective to Hippocampal Neuroplasticity". **2015, 2017**

University of Coimbra, Portugal

- MIT-Portugal PhD Program in Bio-Engineering. Two lectures on: "Introduction to Electrophysiology in Behaving Animals". **March 2014**

The University of Chicago

- "Introduction to Neuroscience" (undergraduate level). Teaching assistant. **Spring 2007**
- "Computational Neuroscience I" (graduate level). Teaching assistant. **Fall 2006**

LEADERSHIP AND MANAGEMENT

- Coursework at Harvard Extension School (HES) and MIT's Sloan School of Business:

"Innovation, Entrepreneurship and Business Transformation" (HES) **Fall 2014**
"Essentials of Executive Speaking" (HES) **Spring 2014**
"Creating and Leading Team Dynamics" (HES) **Fall 2013**
"Negotiation for Executives" (MIT-Sloan) **October 2015**

- Mentorship: Supervised over 10 undergraduate and graduate students at MIT, including underrepresented minorities (URMs) from various international and socioeconomic backgrounds.

SERVICE

- Board member, University of Chicago Alumni Club-Boston chapter **2016**
- Selection committee for the 2016 and 2017 MIT Excellence Awards + Collier Medal **2015-2017**
- Selection committee for the Postdoctoral "Mentor of the Year Award" **2014**
  Brain & Cognitive Sciences Department
- Organizing committee for the MIT-Harvard "2012 European Career Fair" **Sep 2011-Feb 2012**
- Volunteer mentor for URMs with the MAP undergraduate mentoring program, **2011-2013**
  Office of Minority Education, MIT
- Member: Society for Neuroscience
- Reviewer for Rubrik, Neuroscience & Biobehavioral Reviews, Hippocampus