

# Michaël Zugaro

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## Current Position

Research Director at the CNRS (national center for scientific research).

Leader of the team *Brain Rhythms and Neural Coding of Memory* at the Center for Interdisciplinary Research in Biology (Collège de France, CNRS, INSERM).

## Previous Positions and Academic Training

- 2006 Principal Investigator at the CNRS.
- 2002 Post-doctoral fellow in G. Buzsáki's laboratory (Rutgers, USA). Grant: Human Frontiers.
- 2001 PhD in S.I. Wiener's team (Collège de France).
- 1997 DEA in P. Bourgin's team (École Polytechnique).
- 1995 Engineering in Mathematics and Information Technology at Compiègne University of Technology.

## Awards and Distinctions

- 2021 *Équipe FRM*, Fondation pour la Recherche Médicale.
- 2019 *Major Advance in Biology* by the French Academy of Sciences.
- 2012 *Best PhD* for G. Girardeau by the French Society for Neuroscience.
- 2010 *Major Advance in Biology* by the French Academy of Sciences.
- 2008 *Career Development Award* by the Human Frontiers Science Program (HFSP).
- 2002 *Best PhD* by the French Society for Neuroscience.

## Grants

- 2021 Équipe FRM (450,000 €).
- 2021 LabEx *PINEAPPLE* (coordinator) in collaboration with C. Ventalon (ENS) (180,000 €).
- 2017 ANR *DyNet* (coordinator) in collaboration with C. Ventalon (ENS) (501,000 €).
- 2017 CNRS *Instrumentation aux Limites* in collaboration with C. Ventalon (ENS) (18,000 €).
- 2016 MemoLife LabEx (coordinator) in collaboration with C. Ventalon (ENS), A. Fleischmann (CIRB) and K. Benchenane (ESPCI) (120,000 €).
- 2015 ANR *AstroConRipples* in collaboration with N. Rouach (CIRB) (492,000 €).
- 2014 Inter-DIM Equipment (coordinator) for optogenetics in rats at Collège de France (215,000 €).
- 2008 *Career Development Award* by the Human Frontiers Science Program (HFSP) (\$ 300,000).
- ≥ 2006 PhD fellowships (Région Île-de-France, ENP, MENRT, etc.) (>1,110,000 €).

## Publications

### Main Research Articles

- 2019 R. Todorova, M. Zugaro. Isolated cortical computations during delta waves support memory consolidation. *Science* 366(6463):377–81. ↓
- 2018 C. Drieu, R. Todorova, M. Zugaro. Nested sequences of hippocampal assemblies during behavior support subsequent sleep replay. *Science* 362(6415):675–679, doi: 10.1126/science.aat2952. 🏆 Prize by the French Academy of Sciences ↓

- 2016 N. Maingret, G. Girardeau, R. Todorova, M. Goutierre, M. Zugaro. Hippocampo-cortical coupling mediates memory consolidation during sleep. *Nature Neuroscience* 19(7):959–64. 🏆 Highly Cited (top 1%) ↓
- 2014 A. Cei, G. Girardeau, C. Drieu, K. El Kanbi, M. Zugaro. Reversed theta sequences of hippocampal cell assemblies during backward travel. *Nature Neuroscience* 17(5):719–24. ↓
- 2014 G. Girardeau, A. Cei, M. Zugaro. Learning-induced plasticity regulates hippocampal sharp wave-ripple drive. *The Journal of Neuroscience* 34(15):5176–83. ↓
- 2009 G. Girardeau, K. Benchenane, S.I. Wiener, G. Buzsáki, M. Zugaro. Selective suppression of hippocampal ripples impairs spatial memory. *Nature Neuroscience* 10:1222–3. 🏆 Highly Cited (top 1%) 🏆 Prize by the French Academy of Sciences ↓
- 2006 L. Hazan\* & M. Zugaro\* (premiers auteurs équivalents), G. Buzsáki. *Klusters, NeuroScope, NDManager*: a free software suite for neurophysiological data processing and visualization. *Journal of Neuroscience Methods* 155(2):207–16. ↓
- 2005 M. Zugaro, L. Monconduit, G. Buzsáki. Spike phase precession persists after transient intrahippocampal perturbation. *Nature Neuroscience* 8:67–71. ↓
- 2003 M. Zugaro, A. Arleo, A. Berthoz, S.I. Wiener. Rapid spatial reorientation and head direction cells, *The Journal of Neuroscience*, 23(8):3478–82. ↓
- 2001 M. Zugaro, A. Berthoz, S.I. Wiener. Background, but not foreground, spatial cues are taken as references for head direction responses by rat anterodorsal thalamus neurons, *The Journal of Neuroscience* 21(RC154):1–5. ↓

### Other Research Articles

- 2021 V. Oberto\*, C. Boucly\*, HY. Gao\*, R. Todorova, M. Zugaro, S.I. Wiener. Distributed cell assemblies spanning prefrontal cortex and striatum. *Current Biology* 32(1):1–13.e6.
- 2014 J. Catanese, A. Viggiano, E. Cerasti, M. Zugaro, and S.I. Wiener. Retrospectively and prospectively modulated hippocampal place responses are differentially distributed along a common path in a continuous T-maze. *The Journal of Neuroscience* 34(39):13163–9. ↓
- 2013 A. Arleo, C. Déjean, P. Allegraud, M. Khamassi, M. Zugaro, S.I. Wiener. Optic flow stimuli update anterodorsal thalamus head direction neuronal activity in rats. *The Journal of Neuroscience* 33(42):16790–5. ↓
- 2012 J. Catanese, E. Cerasti, M. Zugaro, A. Viggiano, S.I. Wiener. Dynamics of decision-related activity in hippocampus. *Hippocampus* 22(9):1901–11. ↓
- 2009 S. Herwik, S. Kisban, A.A.A. Aarts, K. Seidl, G. Girardeau, K. Benchenane, M. Zugaro, S.I. Wiener, O. Paul, H.P. Neves, P. Ruther. Fabrication technology for silicon-based microprobe arrays used in acute and sub-chronic neural recording. *Journal of Micromechanics and Microengineering* 19:074008. ↓
- 2008 A. Sirota, S. Montgomery, S. Fujisawa, Y. Isomura, M. Zugaro, G. Buzsáki. Entrainment of neocortical neurons and gamma oscillations by the hippocampal theta rhythm. *Neuron* 60(4):683–97. 🏆 Highly Cited (top 1%) ↓
- 2007 C. Geisler, D. Robbe, M. Zugaro, A. Sirota, G. Buzsáki. Hippocampal place cell assemblies are speed-controlled oscillators. *PNAS* 104(19):8149–54. ↓
- 2005 J. P. Bassett, M. Zugaro, G.M. Muir, E.J. Golob, R.U. Muller, J.S. Taube. Passive movements of the head do not abolish anticipatory firing properties of head direction cells. *Journal of Neurophysiology* 93(3):1304–16. ↓
- 2004 M. Zugaro, A. Arleo, C. Dejean, E. Burguiere, M. Khamassi, S.I. Wiener. Rat anterodorsal thalamic head direction neurons depend upon dynamic visual signals to select publications/ct anchoring landmark cues. *European Journal of Neuroscience* 20:530–6. ↓
- 2004 P. Barthó, H. Hirase, L. Monconduit, M. Zugaro, K.D. Harris, G. Buzsáki. Characterization of neocortical principal cells and interneurons by network interactions and extracellular features. *Journal of Neurophysiology* 92:600–8. ↓
- 2002 M. Zugaro, A. Berthoz, S.I. Wiener. Peak firing rates of rat anterodorsal thalamic head direction cells are higher during faster passive rotations, *Hippocampus* 12(4):481–6. ↓
- 2001 M. Zugaro, E. Tabuchi, C.F. Fouquier, A. Berthoz, S.I. Wiener. Active locomotion increases peak firing rates of anterodorsal thalamic head direction cells, *Journal of Neurophysiology* 86(2):692–702. ↓
- 2000 M. Zugaro, E. Tabuchi, S.I. Wiener. Influence of conflicting visual, inertial and substratal cues on head direction cell activity, *Experimental Brain Research* 133:198–208. ↓
- 2000 S.V. Albertin, A.B. Mulder, E. Tabuchi, M. Zugaro, S.I. Wiener. Lesions of the medial shell of the nucleus accumbens impair rats in finding larger rewards, but spare reward-seeking behavior, *Behavioral Brain Research* 117(1–2):173–83. ↓

## Review Articles

- 2019 C. Drieu, M. Zugaro. Hippocampal Sequences During Exploration: Mechanisms and Functions. *Frontiers in Cellular Neuroscience* doi: 10.3389/fncel.2019.00232. ↓
- 2018 R. Todorova, M. Zugaro. Hippocampal ripples as a mode of communication with cortical and subcortical areas. *Hippocampus* doi: 10.1002/hipo.22997. ↓
- 2011 G. Girardeau, M. Zugaro. Hippocampal ripples and memory consolidation. *Current Opinion in Neurobiology*. 21(3):452–9. ↓
- 2002 S.I. Wiener and M. Zugaro, Multisensory processing for the elaboration of place and head direction responses in the limbic system, *Cognitive Brain Research* 14(1):75–90. ↓

## Data Sets

- 2019 N. Maingret, R. Todorova, M. Zugaro. Recordings and timed stimulation of rat dorsal hippocampal area CA1 and medial prefrontal cortex during behavior and sleep. CRCNS.org, <http://doi.org/10.6080/K0TD9VJG>.
- 2018 C. Drieu, R. Todorova, M. Zugaro. Bilateral recordings from dorsal hippocampal area CA1 from rats transported on a model train and sleeping. CRCNS.org, <http://dx.doi.org/10.6080/K0Z899MM>.

## Scientific Collaborations

In recent years, our group has been collaborating with F. Battaglia (Donders Institute, Neijmegen, The Netherlands), K. Benchenane (CNRS, ESPCI, Paris, France), G. Buzsáki (NYU, New York, USA), A. Fleischmann (Inserm, CIRB, Paris, France), T. Jay (Inserm, Sainte Anne, Paris, France), N. Rouach (Inserm, CIRB, Paris, France), J. Touboul (INRIA, CIRB, Paris, France), L. Venance (Inserm, CIRB, Paris, France), C. Ventalon (CNRS, IBENS, Paris, France).