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Positions

- 2016-present Facilitator (Executive Board Chair)
International Brain Laboratory
- 2014-present Director
Champalimaud Research
Champalimaud Foundation, Lisbon, Portugal
- 2010-2014 Director
2007-2010 Coordinator
2007-present Senior Investigator
Champalimaud Neuroscience Programme
Champalimaud Foundation, Lisbon, Portugal
- 2008-2010 Visiting Scientist
Howard Hughes Medical Institute
Janelia Farm Research Campus, Ashburn, VA, USA
- 2007-2011 Principal Investigator
Instituto Gulbenkian de Ciência
Oeiras, Portugal
- 2004-2007 Associate Professor
1999-2003 Assistant Professor
Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, USA
- 1995-1999 Post-doctoral Fellow
Supervisors: Roberto Malinow, Karel Svoboda
Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, USA
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Education

- 1991-1995 Ph.D., Neurosciences
Supervisor: Terrence J Sejnowski
University of California
San Diego, La Jolla, CA, USA
- 1987-1991 B.A., Psychology (summa cum laude)
M.Sc., Psychology
Supervisor: Thomas H Brown
Yale University
New Haven, CT, US
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Publications

- Murakami M, Shteingart H, Loewenstein Y, **Mainen ZF** (2017) Distinct sources of deterministic and stochastic components of action timing decisions in rodent frontal cortex. *Neuron* 94 (4), 908-919.
- Correia PA, Lottem E, Banerjee D, Machado AS, Carey MR, **Mainen ZF** (2017) Transient inhibition and long-term facilitation of locomotion by phasic optogenetic activation of serotonin neurons, *ELife* 14;6.
- Matias S, Lottem E, Dugué GP, **Mainen ZF** (2017) Activity patterns of serotonin neurons underlying cognitive flexibility. *ELife* 21;6.
- Grabska-Barwińska A, Barthelmé S, Beck J, **Mainen ZF**, Pouget A, Latham PE (2017) A probabilistic approach to demixing odors. *Nat Neurosci.* 20, 98-106.
- Kobak D, Brendel W, Constantinidis C, Feierstein CE, Kepecs A, **Mainen ZF**, Romo R, Qi XL, Uchida N, Machens CK (2016) Demixed principal component analysis of neural population data. *eLIFE* 12;5.
- Gomez-Marin A, **Mainen ZF** (2016) Expanding perspectives on cognition in humans, animals, and machines. *Curr Opin Neurobiol.* 37, 85-91.
- Lottem E, Lörincz ML, **Mainen ZF** (2016) Optogenetic activation of dorsal raphe serotonin neurons rapidly inhibits spontaneous but not odor-evoked activity in olfactory cortex. *J Neurosci.* 36 (1), 7-18.
- Meynier F., Sigman M., **Mainen ZF** (2015) Confidence as Bayesian probability: from neural origins to behavior. *Neuron* 88 (1), 78–92.
- Bush PC, **Mainen ZF** (2015) Columnar architecture improves noise robustness in a model cortical network. *PLoS One* 10 (3), e0119072.
- Murakami M, **Mainen ZF** (2015) Preparing and selecting actions with neural populations: toward cortical circuit mechanisms. *Curr Opin Neurobiology* 33, 40-46.
- Fonseca MS, Murakami M, **Mainen ZF** (2015) Activation of dorsal raphe serotonergic neurons promotes persistent waiting independently of reinforcing effects. *Current Biology* 25 (3), 306-15.
- Murakami M, Vicente MI, Costa GM, **Mainen ZF** (2014) Neural antecedents of self-initiated actions in secondary motor cortex. *Nat Neurosci.* 11, 1574-82.
- Dugué GP, Lörincz ML, Lottem E, Audero E, Matias S, Correia PA, Léna C, **Mainen ZF** (2014) Optogenetic recruitment of dorsal raphe serotonergic neurons acutely decreases mechanosensory responsivity in behaving mice. *PLoS One* 9 (8), e105941.
- Gomez-Marin A, Paton JJ, Kampff AR, Costa RM, **Mainen ZF** (2014) Big behavioral data: psychology, ethology and the foundations of neuroscience. *Nat Neurosci.* 11, 1455-62.
- Lak A, Costa GM, Romberg E, Koulakov AA, **Mainen ZF**, Kepecs A (2014) Orbitofrontal cortex is required for optimal waiting based on decision confidence. *Neuron* 84, 190-201.
- Tecuapetla F, Matias S, Dugue GP, **Mainen ZF**, Costa RM (2014) Balanced activity in basal ganglia projection pathways is critical for contraversive movements. *Nat Commun.* 5, 4315.
- Rennie SM, Moita MM, **Mainen ZF** (2013) Social cognition in the rodent: nothing to be sniffed at. *Trends Cogn Sci.* 17 (7), 306-7.

- Zariwala HA, Kepecs A, Uchida N, Hirokawa J, **Mainen ZF** (2013) The limits of deliberation in a perceptual decision task. *Neuron* 78 (2), 339-51.
- Miura K, **Mainen ZF**, Uchida N (2012) Odor representations in olfactory cortex: distributed rate coding and decorrelated population activity. *Neuron* 74 (6), 1087-1098.
- Kepecs A, **Mainen ZF**. (2012) A computational framework for the study of confidence in humans and animals. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.* 367 (1594), 1322-1337.
- Felsen G, **Mainen ZF**. (2012) Midbrain contributions to sensorimotor decision-making. *J Neurophysiol.* 108 (1), 135-47.
- Vicente MI, **Mainen ZF** (2011) Convergence in the piriform cortex. *Neuron* 70 (1), 1-2.
- Feierstein CE, **Mainen ZF** (2010) Listening to the crowd: neuronal ensembles rule. *Neuron* 66 (3), 334-6.
- Ranade SP, **Mainen ZF** (2009) Transient firing of dorsal raphe neurons encodes diverse and specific sensory, motor, and reward events. *J. Neurophysiol.* 102, 3026-3037.
- Quirk MC, Sosulski DL, Feierstein CE, Uchida N and **Mainen ZF** (2009) A defined network of fast-spiking interneurons in orbitofrontal cortex: responses to behavioral contingencies and ketamine administration. *Front Syst Neurosci* 3 (13).
- Dugué GP, **Mainen ZF** (2009) How serotonin gates olfactory information flow. *Nat. Neurosci.* 12, 673-675.
- Mainen ZF**, Kepecs A (2009) Neural representation of behavioral outcomes in the orbitofrontal cortex. *Curr. Opin. Neurobiol.* 19, 84-91.
- Vicente MI, **Mainen ZF** (2008) Towards an image of a memory trace. *Front Neurosci* 2 (2), 131-132.
- Felsen G, **Mainen ZF** (2008) Neural substrates of sensory-guided locomotor decisions in the rat superior colliculus. *Neuron* 60 (1), 137-148.
- Kepecs A, Uchida N, Zariwala HA, **Mainen ZF** (2008) Neural correlates, computation and behavioural impact of decision confidence. *Nature* 455, 227-231.
- Huber D, Petreanu L, Ghitani N, Ranade S, Hromádka T, **Mainen ZF**, Svoboda K (2008) Sparse optical microstimulation in barrel cortex drives learned behaviour in freely moving mice. *Nature* 451, 61-64.
- Uchida N, **Mainen ZF** (2007) Odor concentration invariance by chemical ratio coding. *Front Syst Neurosci* 1 (3).
- Mainen ZF** (2007) The main olfactory bulb and innate behavior: different perspectives on an olfactory scene. *Nat. Neurosci.* 10 (12), 1511-1512.
- Xiao Yun, Donghwi Kim, Stanacevic M., **Mainen ZF**. (2007) Low-power high-resolution 32-channel neural recording system. *Conf Proc IEEE Eng Med Biol Soc*, 2373-2376.
- Sato TR, Gray NW, **Mainen ZF**, Svoboda K (2007) The functional microarchitecture of the mouse barrel cortex. *PLoS Biol.* 5 (7), e189.
- Kepecs AC, Uchida N, **Mainen ZF** (2007) Rapid and precise control of sniffing during olfactory discrimination in rats. *J. Neurophysiol.* 98 (1), 205-13.

- Gurden H, Uchida N, **Mainen ZF** (2006) Sensory-evoked intrinsic optical signals in the olfactory bulb are coupled to glutamate release and uptake. *Neuron* 52 (2), 335-345.
- Feierstein CE, Quirk MC, Uchida N, Sosulski DL, **Mainen ZF**. (2006) Spatial goal representations in orbitofrontal cortex. *Neuron* 51 (4), 495-507.
- Mainen ZF** (2006) Behavioral analysis of olfactory coding and computation in rodents. *Curr. Opin. Neurobiol.* 16, 429-423.
- Wilson R, **Mainen ZF** (2006) Early events in olfactory processing. *Annu. Rev. Neurosci.* 29, 163-201.
- Uchida N, Kepecs A, **Mainen ZF** (2006) Seeing at a glance, smelling in a whiff: rapid forms of perceptual decision making. *Nat. Rev. Neurosci.* 7, 485-491.
- Kepecs A, Uchida N, **Mainen ZF** (2006) The sniff as a unit of olfactory processing. *Chem. Senses* 31, 167-79.
- Egger V, Svoboda K, **Mainen ZF** (2005) Dendrodendritic synaptic signals in olfactory bulb granule cells: local spine boost and global low-threshold spike. *J. Neurosci.* 25, 3521-30.
- Uchida N, **Mainen ZF** (2003) Speed and accuracy of olfactory discrimination in the rat. *Nat. Neurosci.* 6, 1224-1229.
- Egger V, Svoboda K, **Mainen ZF** (2003) Mechanisms of lateral inhibition in the olfactory bulb: efficiency and modulation of spike-evoked calcium influx into granule cells. *J. Neurosci.* 23 (20), 7551-8.
- Malinow R, **Mainen ZF**, Hayashi Y (2000) LTP mechanisms: from silence to four-lane traffic. *Curr. Opin. Neurobiol.* 10 (3), 352-357.
- Maravall M, **Mainen ZF**, Sabatini BL, Svoboda K (2000) Estimating intracellular calcium concentrations and buffering without wavelength ratioing. *Biophys. J.* 78 (5), 2655-2667.
- Mainen ZF**, Maletic-Savatic M, Shi SH, Hayashi Y, Malinow R, Svoboda K (1999) Two-photon imaging in living brain slices. *Methods* 18 (2), 231-239.
- Mainen ZF**, Malinow R, Svoboda K (1999) Synaptic calcium transients in single spines indicate that NMDA receptors are not saturated. *Nature* 399 (6732), 151-155.
- Svoboda K, **Mainen ZF** (1999) Synaptic [Ca²⁺]: intracellular stores spill their guts. *Neuron* 22 (3), 427-430.
- Mainen ZF**, Jia Z, Roder J, Malinow R (1998) Use-dependent AMPA receptor block in mice lacking GluR2 suggests postsynaptic site for LTP expression. *Nat. Neurosci.* 1 (7), 579-586.
- Mainen ZF**, Carnevale NT, Zador AM, Claiborne BJ, Brown TH (1996) Electrotonic architecture of hippocampal CA1 pyramidal neurons based on three-dimensional reconstructions. *J. Neurophysiol.* 76 (3), 1904-1923.
- Malinow R, **Mainen ZF** (1996) Long-term potentiation in the CA1 hippocampus. *Science* 271 (5255), 1604-1606.
- Mainen ZF**, Sejnowski TJ (1996) Influence of dendritic structure on firing pattern in model neocortical neurons. *Nature* 382 (6589), 363-366.
- Mainen ZF**, Joerges J, Huguenard JR, Sejnowski TJ (1995) A model of spike initiation in neocortical pyramidal neurons. *Neuron* 15 (6), 1427-1439.

Mainen ZF, Sejnowski TJ (1995) Reliability of spike timing in neocortical neurons. *Science* 268 (5216), 1503-1506.

Destexhe A, **Mainen ZF**, Sejnowski TJ (1994) Synthesis of models for excitable membranes, synaptic transmission and neuromodulation using a common kinetic formalism. *J Comput Neurosci* 1 (3), 195-230.

Fellowships & Awards

2015 Advanced Investigator Grant from the European Research Council (ERC)

2014 Simons Foundation Grant

2010 Elected Member, European Molecular Biology Organization (EMBO)

2010 Advanced Investigator Grant from the European Research Council (ERC)

2005 NARSAD Lattner Foundation Investigator

2001-2005 Searle Scholar

1997-2002 Burroughs-Wellcome Career Development Award

1995-1997 NRSA Post-doctoral Fellowship

1991-1995 Howard Hughes Medical Institute Pre-doctoral Fellowship

Advisory Boards and Review Panels

2016-present Editorial Board Member, *Current Opinion in Neurobiology*

2015-present Editorial Board Member, *Neural Computation*

2014-present Editorial Board Member, *Current Biology*

2013-present European Research Council Expert Panel

2013-2017 Conselho de Faculdade da Faculdade de Ciências da Universidade Nova de Lisboa, Portugal

2013-present Advisory Board Member, Sociedade Portuguesa de Neurociências

2012-2016 Editorial Advisory Panel, *Nature Communications*, Nature Publishing Group

2011-present Scientific Committee, Champalimaud Neuroscience Symposium

2007-2014 Associate Editor, *Frontiers in Neuroscience*

2005-present Executive Board, Computational and Systems Neuroscience (COSYNE)

2004-2005 Ad-hoc reviewer, NIH ZDC1, NIH ZRG1, NIH SCSS

Reviewer (partial list): *Nature*, *Neuron*, *Nature Neurosci.*, *J Neurosci.*, *J Neurophysiol.*

Meeting Organization

- 2017 Co-chair, *MDMA and psilocybin: Bridging science and clinical application*
Cascais, Portugal
- 2015 Co-Organizer, *Subjective confidence: psychology, physiology, theory*
Fondation Les Treilles, Tourtour, France
- 2008 Co-Organizer, *Neural Circuits and Decision-Making in Rodents*
Janelia Farm, Ashburn, VA, USA
- 2007 Co-Organizer, *Theoretical and Experimental Perspectives on Serotonin Function*
Ericeira, Portugal
- 2005-present Program Chair/ General Chair /Executive Committee, *Computational and Systems Neuroscience (COSYNE)*, Salt Lake City, UT, USA
- 2005 Co-Organizer, *Neural Information and Coding International (NICI)*
Karnataka, India
- 2001 Co-Organizer, *Neural Information and Coding Europe (NICE)*
Les Houches, France
- 2000 Co-Organizer, *Banbury Workshop on "Neural networks and Cognition"*
Cold Spring Harbor, NY, USA
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Teaching & Courses

- 2016 Instructor
Neuroengineering course
Instituto Superior Técnico, Universidade de Lisboa, Portugal
- 2014-present Co-Organizer
CAJAL Advanced Neuroscience Training Programme (FENS-IBRO)
Champalimaud Centre for the Unknown, Lisbon, Portugal
- 2010-present Co-Director
Computational and Cognitive Neuroscience Summer School
Cold Spring Harbor Asia, Suzhou & Beijing, China
- 2007-2011 Director
International Neuroscience Doctoral Programme
Instituto Gulbenkian de Ciência & Champalimaud Foundation
Lisbon, Portugal
- 2007-present Instructor
International Neuroscience Doctoral Programme
Instituto Gulbenkian de Ciência & Champalimaud Foundation
Lisbon, Portugal
- 2001-2006 Instructor
Watson School of Biological Sciences
Cold Spring Harbor Laboratory, NY, USA
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Invited Seminars (2012-2017)

2017

- “Chemical Neuromodulation: Neurobiological, Neurocomputational, Behavioural and Clinical Aspects”, FENS SfN Summer School, Bertinoro, Italy
- “Sussex Neuroscience Day”, University of Sussex, UK

2016

- Centre for Theoretical Neuroscience, Columbia University, New York City, USA
- “Complexity of Neural Computation and Cognition” workshop, Janelia Farm Research Campus, Ashburn, VA, USA
- FENS Forum, Copenhagen, Denmark
- Gatsby Computational Neuroscience Unit, University College London, London, UK
- “Uncertainty and Action” workshop, Kavli Center at Chicheley Hall, The Royal Society, Chicheley, UK
- “Sensory logic of the Gastronomic Brain” workshop, San Sebastian, Spain
- CEDOC, NOVA Medical School, Lisbon, Portugal

2015

- SCiNDU, Queensland Brain Institute, University of Queensland, Brisbane, Australia
- Imperial College London, London, UK
- Oxford University, Oxford, UK
- Canonical Neural Computations, NYU, Florence, Italy
- “International Brain Projects”, Cold Spring Harbor Asia, Suzhou, China
- Charité - Universitätsmedizin Berlin, Germany
- The Gatsby Computational Neuroscience Unit, University College London, UK
- ICONE - International Conference on Neuroethics, Lisbon, Portugal
- CoSyNe workshops, Snowbird, USA
- FENS-Hertie Winter School "The neuroscience of decision making", Obergurgl, Austria

2014

- SISSA, Trieste, Italy
- “The aims of brain research: scientific and philosophical perspective”, The 28th Annual International Workshop on the History and Philosophy of Science, Van Leer Jerusalem Institute, Israel
- 1st joint Postdoc meeting IMM, IGC, CEDOC, Sintra, Portugal
- Boom Festival, Idanha-a-Nova, Portugal
- “Mapping the Unknown”, Ar Event, Champalimaud Centre for the Unknown, Lisbon, Portugal
- 79th Cold Spring Harbor Symposium on Quantitative Biology “Cognition”, Cold Spring Harbor, New York, USA
- “Controlling Neurons, Circuits, Behavior”, FENS Spring Brain Conference, Rungstedgaard, Copenhagen, Denmark
- 16th International Neuroscience Winter Conference, Sölden, Austria
- CoSyNe, Salt Lake City, USA
- CoSyNe workshops, Snowbird, USA

2013

- “A Multilevel Approach to Distributed Cognition”, ESCON2, Cascais, Portugal
- Institute of Neuroinformatics, University of Zurich, Switzerland
- University of Geneva, Switzerland
- 3rd Latin American School for Education, Cognitive and Neural Sciences, Comandatuba, Brazil
- TEDx O’Porto, Porto, Portugal
- 1st ENCODS Conference, Bordeaux, France
- “Temporal Dynamics in Learning: Networks and Neural Data”, Janelia Farm Research Campus, Ashburn, VA, USA

- “Noise in Decision Making: Theory meets Experiment”, ESF Exploratory Workshop, Centre de Recerca Matemàtica, Barcelona, Spain
- Institute of Neuroscience, Shanghai, China

2012

- CoSyNe, Salt Lake City, USA
- CoSyNe workshops, Snowbird, USA
- Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, USA
- Stanford University, USA
- NERF Neurotechnology Symposium, Leuven, Belgium
- Brain dynamics and decision making, Ascona, Switzerland
- Canonical Neural Computation, NYU, Florence, Italy