

**BIOGRAPHICAL SKETCH**

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NAME: Foffani, Guglielmo (birth date 07/13/1977)

POSITION TITLE: Scientific Coordinator, CINAC, HM Hospitales (Madrid, Spain)

**EDUCATION/TRAINING:**

INSTITUTION AND LOCATION	DEGREE	Completion Date	FIELD OF STUDY
Politecnico di Milano, Italy	B.S./M.S. (5 years)	07/2001	Biomedical Engineering
Drexel University, Philadelphia, USA	Ph.D. (3 years)	12/2004	Biomedical Engineering
IE Business School, Madrid, Spain	Executive Education Program (6 months)	03/2013	Management and Entrepreneurship

**A. Personal Statement**

Biomedical Engineer from Politecnico di Milano, Italy (2001), and Doctor in Bioengineering from Drexel University, Philadelphia USA (2004), and from Politecnico di Milano (2005), since January 2005 he works as investigator at Hospital Nacional de Paraplégicos in Toledo (Spain), where he is Director of the Neural Bioengineering Group. In December 2014 he joins CINAC of HM Hospitales in Madrid (Spain), where he is Scientific Coordinator. Since 2003 he published > 80 papers that received > 4000 citations, with an h-index of 35 (Google Scholar). He is co-inventor in 7 patents and 1 utility model, and is co-founder of two spinoff companies that currently develop and commercialize invasive and non-invasive brain stimulation technologies (Newronika s.r.l., Italy, and Neurek SL, Spain). Among other awards, in 2009 he received the first Olympus Young Investigator Award by the Spanish Society for Neuroscience (SENC). In 2017, he was elected as Member of the Board of Directors of SENC. He is pianist of the group Ayahuasca Tango ([www.ayahuascatango.org](http://www.ayahuascatango.org)) and of the project "La Casa del Pianista" ([www.facebook.com/lacasadelpianista](http://www.facebook.com/lacasadelpianista)).

**B. Positions and Honors****Positions and Employment**

2002-2003 Calhoun Fellow, School of Biomedical Engineering, Drexel University, Philadelphia PA.  
 2004 Research Assistant, School of Biomedical Engineering, Drexel University, Philadelphia PA.  
 2005-2013 Research Assistant Professor, School of Biomedical Engineering, Drexel University.  
 2005- Investigator, Hospital Nacional Paraplégicos, Toledo (Spain).  
 2010- President, Neurek SL, Toledo (Spain)  
 2014- Investigator, Centro Integral de Neurociencia A.C. (CINAC), HM Hospitales, Madrid (Spain).

**Other Experience and Professional Memberships**

2002- Member, Society for Neuroscience  
 2005- Member, Spanish Society for Neuroscience (SENC, Spain)  
 2004- Reviewer, scientific journals in the fields of neuroscience, neurology and neuroengineering  
 2007- Reviewer, National Agency of Project Evaluation (ANEP, Spain)  
 2012- Academic Editor, PLOS ONE  
 2017- Board of Directors, Spanish Society for Neuroscience (SENC, Spain)  
 2019- Scientific Advisory Board, Newronika s.r.l. (Italy)

## Honors

2001	Paolo Mancini Master Thesis Award, Gruppo Nazionale di Bioingegneria (Italy)
2002	Graduate Student Poster Award, Northeast Bioengineering Conference, Philadelphia PA
2002	Joseph S. Mozino Scholarship, College of Engineering, Drexel University, Philadelphia, PA
2003	Excellence in Neural Engineering Competition Award, IEEE-EMBS, Capri Island (Italy)
2003	Professor Guglielmo Scarlato Award, Società Italiana di Neurologia (SIN).
2004	Premio alla cultura, XXXI Congresso Nazionale LIMPE, Padova (Italy)
2005	Loring Biomedical Technology Entrepreneurship Award, Drexel University, Philadelphia PA
2005	Award for significant achievement reflecting credit on Drexel, Philadelphia PA
2006	Premio di Dottorato, Gruppo Nazionale di Bioingegneria (Italy).
2008	Premio 20 Aniversario del Complejo Hospitalario de Albacete (Spain).
2008	Premio Joven Investigador Luisa Sigea de Velasco, JCCM (Spain).
2009	Premio Olympus, Spanish Society for Neuroscience (SENC, Spain)
2014	National Scientific Qualification ("Abilitazione Scientifica Nazionale) in three different fields: Neurology, Physiology and Biomedical Engineering, MIUR (Italy)

## C. Contributions to Science

Selected publications (\*equal contribution, <sup>c</sup>corresponding author)

### Reviews and perspectives

- 1) **G. Foffani\***, I. Trigo-Damas\*, J.A. Pineda-Pardo, J. Blesa, R. Rodríguez-Rojas, R. Martínez-Fernández, J.A. Obeso. Focused ultrasound in Parkinson's disease: A twofold path toward disease modification. *Mov Disord* 34:1262-1273 (2019)
- 2) M.H.G. Monje, **G. Foffani**, J. Obeso, A. Sánchez-Ferro. New Sensor and Wearable Technologies to Aid in the Diagnosis and Treatment Monitoring of Parkinson's Disease. *Annu Rev Biomed Eng* 21:111-143 (2019).
- 3) **G. Foffani**<sup>c</sup> and J.A. Obeso<sup>c</sup>. A cortical pathogenic theory of Parkinson's disease. *Neuron* 99:1116-1128 (2018)
- 4) K.A. Moxon<sup>c</sup>, **G. Foffani**<sup>c</sup>. Brain-machine interfaces beyond neuroprosthetics. *Neuron* 86:55-67 (2015).
- 5) K.A. Moxon<sup>c</sup>, A. Oliviero, J. Aguilar, **G. Foffani**<sup>c</sup>. Cortical reorganization after spinal cord injury: always for good? *Neuroscience* 283:78-94 (2014).
- 6) A. Priori, **G. Foffani**, L. Rossi, S. Marceglia. Adaptive Deep Brain Stimulation (aDBS) controlled by local field potential oscillations. *Exp Neurol* 245:77-86 (2013).

### Parkinson's disease

- 7) M. Arlotti, S. Marceglia, **G. Foffani**, J. Volkmann, A.M. Lozano, E. Moro, F. Cogiamanian, M. Prenassi, T. Bocci, F. Cortese, P. Rampini, S. Barbieri, A. Priori. Eight-hours adaptive deep brain stimulation in patients with Parkinson's Disease. *Neurology*, 90:e971-e976 (2018).
- 8) R. Martínez-Fernández, R. Rodríguez-Rojas, M. del Álamo, F. Hernández-Fernández, J.A. Pineda-Pardo, M. Dileone, F. Alonso-Frech, **G. Foffani**, I. Obeso, C. Gasca-Salas, E. de Luis-Pastor, L. Vela, J.A. Obeso. Focused ultrasound subthalamotomy in patients with asymmetric Parkinson's disease: a pilot study. *Lancet Neurol* 17:54-63 (2018).
- 9) M. Dileone, M.C. Carrasco-López, J.C. Segundo-Rodríguez, L. Mordillo-Mateos, N. López-Ariztegui, F. Alonso-Frech, M.J. Catalan-Alonso, J.A. Obeso, A. Oliviero<sup>c</sup>, **G. Foffani**<sup>c</sup>. Dopamine-dependent changes of cortical excitability induced by transcranial static magnetic field stimulation in Parkinson's disease. *Sci Rep* 7:4329 (2017).
- 10) S.F. Danish, J.T. Moyer, L.H. Finkel, G.H. Baltuch, J.L. Jaggi, A. Priori, **G. Foffani**<sup>c</sup>. High-frequency oscillations (>200Hz) in the human non-parkinsonian subthalamic nucleus. *Brain Res Bull* 74, 84-90 (2007).
- 11) L. Rossi\*, **G. Foffani\***, S. Marceglia, F. Bracchi, S. Barbieri, A. Priori. An electronic device for artefact suppression in human local field potential recordings during deep brain stimulation. *J Neural Eng* 4, 96-106 (2007).
- 12) A. Priori, G. Ardolino, S. Marceglia, S. Mrakic-Sposta, M. Locatelli, F. Tamma, L. Rossi, **G. Foffani**. Low-frequency subthalamic oscillations increase after deep brain stimulation in Parkinson's disease. *Brain Res Bull* 71, 149-154 (2006).

- 13) S. Marceglia\*, **G. Foffani\***, A.M. Bianchi, G. Baselli, F. Tamma, M. Egidi, A. Priori. Dopamine-dependent non-linear correlation between subthalamic rhythms in Parkinson's disease. *J Physiol* 571, 579-591 (2006).
- 14) **G. Foffani**, G. Ardolino, M. Egidi, E. Caputo, B. Bossi, A. Priori. Subthalamic oscillatory activities at beta or higher frequency do not change after high-frequency DBS in Parkinson's disease. *Brain Res Bull* 69, 123-130 (2006).
- 15) **G. Foffani**, A.M. Bianchi, G. Baselli, A. Priori. Movement-related frequency modulation of beta oscillatory activity in the human subthalamic nucleus. *J Physiol* 568, 699-711 (2005).
- 16) **G. Foffani**, G. Ardolino, B. Meda, M. Egidi, P. Rampini, E. Caputo, G. Baselli, A. Priori. Altered subthalamo-pallidal synchronization in parkinsonian dyskinesias. *J Neurol Neurosurg Psychiatry* 76, 426-428 (2005).
- 17) **G. Foffani**, G. Ardolino, P. Rampini, F. Tamma, E. Caputo, M. Egidi, S. Cerutti, S. Barbieri, A. Priori. Physiological recordings from electrodes implanted in the basal ganglia for deep brain stimulation in Parkinson's disease. The relevance of fast subthalamic rhythms. *Acta Neurochirurgica [Suppl]* 93: 97-99 (2005).
- 18) **G. Foffani**, A.M. Bianchi, A. Priori, G. Baselli. Adaptive autoregressive identification with spectral power decomposition for studying movement-related activity in scalp EEG signals and basal ganglia local field potentials. *J Neural Eng* 1:165-173 (2004).
- 19) A. Priori\*, **G. Foffani\***, A. Pesenti, F. Tamma, A.M. Bianchi, M. Pellegrini, M. Locatelli, K.A. Moxon, and R. M. Villani. Rhythm-specific pharmacological modulation of subthalamic activity in Parkinson's disease. *Exp Neurol* 189:369-379 (2004).
- 20) **G. Foffani\***, A. Priori\*, M. Egidi, P. Rampini, F. Tamma, E. Caputo, K.A. Moxon, S. Cerutti, S. Barbieri. 300-Hz subthalamic oscillations in Parkinson's disease. *Brain* 126, 2153-2163 (2003).

#### Non-invasive brain stimulation

- 21) J.A. Pineda-Pardo\*, I. Obeso\*, P. Guida, M. Dileone, B. Strange, J.A. Obeso, A. Oliviero, **G. Foffani**<sup>c</sup>. Static magnetic field stimulation of the supplementary motor area modulates resting-state activity and motor behavior. *Commun Biol* 2:397 (2019).
- 22) M. Dileone\*, L. Mordillo-Mateos\*, A. Oliviero<sup>c</sup>, **G. Foffani**<sup>c</sup>. Long-lasting effects of transcranial static magnetic field stimulation on motor cortex excitability. *Brain Stimul* 11:676-688 (2018).
- 23) C. Carrasco-López, V. Soto-León, V. Céspedes, P. Profice, B. A. Strange, **G. Foffani**<sup>c</sup>, A. Oliviero<sup>c</sup>. Static magnetic field stimulation over parietal cortex enhances somatosensory detection in humans. *J Neurosci* 37:3840-3847 (2017).
- 24) J.J. Gonzalez-Rosa, V. Soto-Leon, P. Real, C. Carrasco-Lopez, **G. Foffani**, B.A. Strange, A. Oliviero. Static Magnetic Field Stimulation over the Visual Cortex Increases Alpha Oscillations and Slows Visual Search in Humans. *J Neurosci* 35:9182-9193 (2015).
- 25) A. Oliviero<sup>c</sup>, M. C. Carrasco-López, M. Campolo, Y.A. Perez-Borrego, V. Soto-León, J. Gonzalez-Rosa, A.M. Higuero, B.A. Strange, J. Abad-Rodriguez, **G. Foffani**<sup>c</sup>. Safety Study of Transcranial Static Magnetic Field Stimulation (tSMS) of the Human Cortex. *Brain Stimul*, 8:481-485 (2015).
- 26) A. Oliviero, L. Mordillo-Mateos, P. Arias, I. Panyavin, **G. Foffani**, J. Aguilar. Transcranial static magnetic field stimulation of the human motor cortex. *J Physiol* 589(Pt 20):4949-4958 (2011).
- 27) A.C. Merzagora, **G. Foffani**, I. Panyavin, L. Mordillo-Mateos, J. Aguilar, B. Onaral, A. Oliviero. Prefrontal Hemodynamic Changes Produced by Anodal Direct Current Stimulation. *Neuroimage* 49, 2304-2310 (2010).

#### Spinal cord injury

- 28) E. Fernández-López, E. Alonso-Calviño, D. Humanes-Valera, **G. Foffani**<sup>c</sup>, J. Aguilar<sup>c</sup>. Slow-wave activity homeostasis in the somatosensory cortex after spinal cord injury. *Exp Neurol* 322:113035 (2019).
- 29) A. Manohar\*, **G. Foffani\***, P.D. Ganzer, J. R. Bethea, K.A. Moxon. Cortex-dependent recovery of unassisted hindlimb locomotion after complete spinal cord injury in adult rats. *eLife* 26:e23532 (2017).
- 30) D. Humanes-Valera\*, **G. Foffani\***<sup>c</sup>, E. Alonso-Calviño, E. Fernández-López, J. Aguilar\*<sup>c</sup>. Dual cortical plasticity after spinal cord injury. *Cereb Cortex* 27:2926-2940 (2017).
- 31) **G. Foffani**, J. Shumsky, E.B. Knudsen, P. D. Ganzer, K.A. Moxon. Interactive effects between exercise and serotonergic pharmacotherapy on cortical reorganization after spinal cord injury. *Neurorehabil Neural Repair* 30:479-489 (2016).

- 32) J.C. Yague, D. Humanes-Valera, J. Aguilar, **G. Foffani**<sup>c</sup>. Functional reorganization of the forepaw cortical representation immediately after thoracic spinal cord hemisection in rats. *Exp Neurol* 257:19-24 (2014).
- 33) D. Humanes-Valera, J. Aguilar<sup>c</sup>, **G. Foffani**<sup>c</sup>. Reorganization of the intact somatosensory cortex immediately after spinal cord injury. *PLOS ONE* 8:e69655 (2013).
- 34) A. Graziano\*, **G. Foffani**\*, E.B. Knudsen, J. Shumsky, K.A. Moxon. Passive exercise of the hind limbs after complete thoracic transection of the spinal cord promotes cortical reorganization. *PLOS ONE* 8:e54350 (2013).
- 35) J. Aguilar<sup>c</sup>, F. Pulecchi, R. Dilena, A. Oliviero, A. Priori, **G. Foffani**<sup>c</sup>. Spinal direct current stimulation modulates the activity of gracile nucleus and primary somatosensory cortex in anesthetized rats. *J Physiol* 589:4981-4996 (2011).
- 36) **G. Foffani**<sup>c</sup>, D. Humanes-Valera, F. Calderon-Muñoz, A. Oliviero, J. Aguilar<sup>c</sup>. Spinal cord injury immediately decreases anesthetic requirements in rats. *Spinal Cord* 49:822-826 (2011).
- 37) J.G. Yague, **G. Foffani**<sup>c</sup>, J. Aguilar<sup>c</sup>. Cortical hyperexcitability in response to preserved spinothalamic inputs immediately after spinal cord hemisection. *Exp Neurol* 227:252-263 (2011).
- 38) J. Aguilar<sup>c</sup>, D. Humanes-Valera, E. Alonso-Calviño, J.G. Yague, K.A. Moxon, A. Oliviero, **G. Foffani**<sup>c</sup>. Spinal cord injury immediately changes the state of the brain. *J Neurosci* 30:7528-7537 (2010).

#### Neural coding

- 39) C. Liu\*, **G. Foffani**<sup>cc</sup>, A. Scaglione, J. Aguilar, K.A. Moxon<sup>cc</sup>. Adaptation of thalamic neurons provides information about the spatiotemporal context of stimulus history. *J Neurosci*, 37:10012-10021 (2017).
- 40) A. Scaglione, **G. Foffani**, K.A. Moxon. Spike count, spike timing and temporal information in the cortex of awake, freely moving rats. *J Neural Eng* 11:046022 (2014).
- 41) A. Scaglione, K.A. Moxon, J. Aguilar, **G. Foffani**<sup>c</sup>. Trial-to-trial variability in the responses of neurons carries information about stimulus location in the rat whisker thalamus. *Proc Natl Acad Sci U S A* 108:14956-14961 (2011).
- 42) A. Scaglione, K.A. Moxon, **G. Foffani**<sup>c</sup>. General Poisson exact breakdown of the mutual information to study the role of correlations in populations of neurons. *Neural Comput* 22,1445-1467 (2010).
- 43) **G. Foffani**<sup>c</sup>, M.L. Morales-Botello, J. Aguilar. Spike-timing, spike-count and temporal information for the discrimination of tactile stimuli in the rat ventrobasal complex. *J Neurosci* 29, 5964-5973 (2009).
- 44) **G. Foffani**, J.K. Chapin, K.A. Moxon. Computational role of large receptive fields in the primary somatosensory cortex. *J Neurophysiol*, 100, 268-280 (2008).
- 45) A. Scaglione\*, **G. Foffani**<sup>cc</sup>, G. Scannella, S. Cerutti, K.A. Moxon. Mutual information expansion for studying the role of correlations in population codes: how important are auto-correlations? *Neural Comput*, 20, 2662-2695 (2008).
- 46) **G. Foffani**, B. Tutunculer, K.A. Moxon. Role of spike timing in the forelimb somatosensory cortex of the rat. *J Neurosci* 24:7266-7271 (2004).
- 47) **G. Foffani**, K.A. Moxon. PSTH-based classification of sensory stimuli using ensembles of single neurons. *J Neurosci Methods* 135:107-120 (2004).

#### Hippocampus

- 48) E. Bellistri, J. Aguilar, J.R. Brotons-Mas, **G. Foffani**<sup>c</sup>, L. Menendez de la Prida<sup>c</sup>. Basic properties of somatosensory-evoked responses in the dorsal hippocampus of the rat. *J Physiol* 591:2667-2686 (2013).
- 49) J.M. Ibarz\*, **G. Foffani**\*, E. Cid, M. Inostroza, L. Menendez de la Prida\*. Emergent dynamics of fast ripples in the epileptic hippocampus. *J Neurosci* 30:16249-16261 (2010).
- 50) **G. Foffani**\*, Y.G. Uzcategui\*, B. Gal, L. Menendez de la Prida. Reduced spike-timing reliability correlates with the emergence of fast ripples in the rat epileptic hippocampus. *Neuron* 55, 930-941 (2007).

### **D. Additional Information: Research Support and/or Scholastic Performance**

#### Patents and utility models

- 1) A. Oliviero, **G. Foffani**, L. Huber. Device for stimulating the nervous system by means of magnetic fields. PCT/ES2016/000100, 15 September 2016. Owned by Neurek SL.
- 2) A. Oliviero, **G. Foffani**, L. Huber. Dispositivo para estimulación del sistema nervioso por medio de campos magnéticos. 15-7863 MU, 15 September 2015. Owned by Neurek SL. [utility model]

- 3) A. Oliviero, J. Aguilar, **G. Foffani**, L. Mordillo-Mateos. Dispositivo para estimulación del sistema nervioso por medio de campo magnético estático y uso de dicho dispositivo. PCT/ES2011/070290, 25 April 2011. Patent awarded in Spain (201030610), licenced to Neurek SL.
- 4) A. Oliviero, **G. Foffani**, I. Panyavin, L. Mordillo, J. Aguilar, A. Merzagora, K. Pourrezaei. Concurrent stimulation effect detection. PCT/US2011/026268, 25 February 2011.
- 5) A. Oliviero, J. Aguilar, M. Rotondi, E. Molina, L. Chiovato, **G. Foffani**, L. Mordillo, A. Lozano, D. García, A. Arévalo, Y. Pérez. Use of inverse antagonists and/or agonists of CB1 receptors for preparing drugs to increase motor neurone excitability. PCT/ES2010/070012, 15 July 2010. Licenced to Samos Medical Enterprise SL.
- 6) B. Moreno, A. del Campo, E. Villanueva, E. Chinarro, J. R. Jurado, D. Guinea, A. Oliviero, V. Soto León, **G. Foffani**. Electrodo para registro de señales bioeléctricas y su procedimiento de fabricación. P200803256, 8 November 2008. PCT/ES2009/070501
- 7) K. Moxon, **G. Foffani**. Method to quantitatively measure effect of psychotropic drugs on sensory discrimination. PCT/D2027 20123, 19 January 2007.
- 8) A. Priori, **G. Foffani**, L. Rossi. Apparatus for treating neurological disorders by means of chronic adaptive brain stimulation as a function of local biopotentials. PCT/IB2006/002184, 3 August 2006. Licenced to Newronika s.r.l.

#### Ongoing research support

**(2018-2020)** Ministerio de Industria, Economía y Competitividad (Spain) SAF2017-86246-R

*Estimulación transcraneal por campo magnético estático en la enfermedad de Parkinson*

Amount: 181.500 € (+90.000 € for PhD fellowship). Principal investigator: **Guglielmo Foffani**

#### Completed research support

**(2014-2018)** Michael J. Fox Foundation (USA) Grant ID: 9205

*Prevention of levodopa-induced dyskinesias by transcranial static magnetic field stimulation (tSMS)*

Amount: 400.000 \$. Principal investigator: **Guglielmo Foffani**

**(2012-2015)** Fondo de Investigaciones Sanitarias del Instituto de Salud Carlos III (Spain) (PI11/02451)

Amount: 75.000 €. Principal investigator: **Guglielmo Foffani**

**(2011-2014)** International Foundation for Research in Paraplegia (Switzerland) (P120)

Amount: 150.000 CHF. Principal investigator: **Guglielmo Foffani**

**(2009-2011)** Fondo de Investigaciones Sanitarias del Instituto de Salud Carlos III (Spain)(PI081852).

Amount: 90.750 € Principal investigator: **Guglielmo Foffani**

**(2007-2009)** Fundación para la Investigación Sanitaria en Castilla-La Mancha, FISCAM (Spain (PI-2006/49).

Amount: 90.559 €. Principal investigator: **Guglielmo Foffani**

**(2006-2007)** Johnson & Johnson, COSAT (USA)

Amount: 80.000 \$. Principal investigator: **Guglielmo Foffani**

**(2006-2008)** Fondo de Investigaciones Sanitarias del Instituto de Salud Carlos III (Spain) (PI05 2322)

Amount: 111.860 €. Principal investigator: **Guglielmo Foffani**

**(2006-2008)** Consejería de Sanidad de la Junta de Comunidades de Castilla-La Mancha (Spain) (06056-00)

Amount: 100.510 €. Principal investigator: **Guglielmo Foffani**

**(2006-2008)** Consejería de Educación y Ciencia, Junta de Comunidades de Castilla-La Mancha (Spain)

(PAI06-0104)

Amount: 87.965 € Principal investigator: **Guglielmo Foffani**

**(2004-2005)** National Parkinson Foundation, Miami FL (USA)

Amount: \$40.000. Principal investigator: Guglielmo Foffani.