



**Lia Chiara Forti**

UNIVERSITY OF INSUBRIA



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## Contact data

### Assistant Professor

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## Biography

1987: Physics Degree (110/110), University of Milano, with a Thesis on an analytical and computational model of radiation-matter interaction in the framework of classical electrodynamics. After graduation Lia Forti shifts her interests to Biophysics and Neuroscience.

1992: PhD in Biophysics at SISSA/ISAS (Trieste, Italy; supervisor: D.Pietrobon, Padova). Thesis work on functional properties of voltage-dependent calcium channels studied with the patch-clamp technique: description of an anomalous L-type calcium channel in cerebellar neurons.

1993-1997: Post-doct. fellow at DIBIT (Milano), studying synaptic transmission in hippocampal neurons with A.Malgaroli. Publishes a report on quantal size measured at single synapses.

1997-1999: Post-doct. fellow at the Max-Planck Institut (MPIbC) in Gottingen, with A.Marty and I.Llano. Patch-clamp and fluorescence calcium imaging measurements from axons of cerebellar interneurons in rat brain slices, studying axonal firing and calcium channels.

1999 - 2007: Research Fellow at the Neurophysiology Lab. directed by E.D'Angelo in Pavia. Patch-clamp studies of inhibitory cerebellar interneurons; study of intrinsic excitability and pacemaker mechanisms of Golgi cells, and more recently the excitatory synaptic inputs to these interneurons.

Since 2008: Researcher/Assistant Professor at the University of Insubria. While continuing the collaboration with Pavia on cerebellar interneurons, L. Forti is now also establishing a multi-electrode-array (MEA) unit for slice electrophysiology at the DBSF in Busto Arsizio, in collaboration with R.Fesce.

Since 2000, Teacher at various Universities (Biological Physics Lab., Physics Degree, University of Milano; Applied Physics Lab, Biotechnology and Medical Biology Degrees, University of Insubria).

## Qualifications and

Degree in Physics, 1987, University of Milano Biophysics PhD, 1992,

## awards

SISSA/ISAS, Trieste.

INFM Researcher (Istituto Naz. Fisica della Materia), 1999-2004

Since 2008, Researcher (Applied Physics) at University of Insubria

## Research interests

*My present research interests are focused on understanding the functional organization of the mammalian cerebellar circuitry, and in particular the functional role played by cerebellar inhibitory interneurons in the processing of incoming information. To this end, current research is focused on functional properties of the excitatory synaptic inputs to cerebellar Golgi cells.*

The cerebellum is a part of the nervous system involved in control of sensori-motor processes. It is organized in “modules”, separately receiving and sending input/output to specific external structures. It is believed that all modules (or zones/microzones), sharing a stereotyped cellular structure, process incoming signals following a common algorithm which is however still unclear. The Golgi cell (GoC) are the major inhibitory interneuron type in the cerebellar cortex. GoCs receive excitatory inputs from outside the cerebellum (mossy and climbing fibers, implementing feed-forward excitation), and also from cerebellar granule cells (feed-back excitation). Various roles in cerebellar processing are predicted for GoCs, from lateral inhibition (spatial selection of activated vs. non-activated cell groups), to gain control upon intense excitation, to definition of dynamic time windows for input transmission to the inner layers of the cerebellar cortex. To understand the role(s) of GoC, a number of issues should be clarified: i) the precise numerical relations defining the convergence/divergence of inputs/outputs from a Golgi cell; ii) the functional properties (efficacy, frequency response, long term plasticity) of excitatory synaptic inputs to GoCs, to present largely ignored; iii) as a consequence, it is not known how many inputs are required to fire a GoC, and on which occasions are the feed-forward and feed-back excitation pathways respectively successful in eliciting a spike. While, in the recent years, we have described the intrinsic excitability and pacemaker properties of GoCs, I am presently actively involved in answering the above questions about synaptic inputs, using patch-clamp electrophysiological methods and 2-photon fluorometric calcium measurements in rat cerebellar slices, coupled with mathematical modeling of single-cell and network behaviour. The implementation of multielectrode-arrays (MEA) measurements on slices, which would allow monitoring the spatial distribution of population neuronal activity, is now underway.

In the past (1993-1997), I have been involved in study of quantal properties of synaptic transmission at hippocampal synapses, with a particular effort to describe quantal size and variability at a single synapse.

Another earlier line of research (1991-1993) has been the biophysical description of various types of voltage-dependent calcium channels in cerebellar granule neurons.

## Teaching

Since 2003: Applied Physics Laboratory (5 CFU), Biotechnology Degree,

## experience and appointments

University of Insubria.

Since 2004: Applied Physics Laboratory (5 CFU), Medical Biology Degree, University of Insubria.

2005-2006: Physics Course (6 CFU), Biotechnology Degree, Università Vita e Salute San Raffaele, Milano.

2000-2004: Biophysics Laboratory (5 CFU), Physics Degree, Università degli Studi (Milano, Italy).

1999-2000: Invited Lectures in Membrane Biophysics (20 hrs), Physics Degree, Università degli Studi, (Milano, Italy).

Faculty Member for the PhD Course in Neuroscience at DBSF, University of Insubria.

Thesis Supervisor of several students for the Degree in Physics (Milano; Laurea Quadriennale; from 1997 to 2006) and the Degree in Biological Sciences (Pavia; 2004).

## Representative publications

1. S.M.Solinas, L.Forti, E.Cesana, J.Mapelli, E.De Schutter and E.D'Angelo (2007). "Computational reconstruction of pacemaking and intrinsic electroresponsiveness in cerebellar Golgi cells". *Frontiers in Cellular Neuroscience*, vol.1(1). [frontiersin.org/neuroscience](http://frontiersin.org/neuroscience) (ENG).
2. S.M. Solinas, L.Forti, E.Cesana, J.Mapelli, E.De Schutter and E.D'Angelo (2007). "Fast-reset of pacemaking and theta-frequency resonance patterns in cerebellar Golgi cells: simulations of their impact in vivo". *Frontiers in Cellular Neuroscience*, vol.1(1) [frontiersin.org/neuroscience](http://frontiersin.org/neuroscience) (ENG).
3. L.Forti, E.Cesana, J.Mapelli, & E.D'Angelo (2006). "Ionic mechanisms of autorhythmic firing in cerebellar Golgi cells". *J. Physiol.*, 574(3):711-729 (ENG).
4. D.Gall, F.Prestori, A.D'Errico, C.Roussel, E.Sola, L.Forti, P.Rossi & E.D'Angelo (2005). "Intracellular calcium regulates bidirectional long-term synaptic plasticity at the mossy fiber-cerebellar granule cell synapse". *J Neurosci.*, 25(19):4813-22 (ENG).
5. A.Abenavoli, L.Forti, M.Bossi, A. Bergamaschi, A.Villa & A.Malgaroli (2002). "Multimodal Quantal Release at individual hippocampal synapses: evidence for lack of lateral inhibition". *J Neurosci.*, 22(15):6336-46 (ENG).
6. L.Forti, C. Pouzat & I.Llano (2000). "Action potential-evoked Ca<sup>2+</sup> signals and calcium channels in axons of developing rat cerebellar interneurons", *J. Physiol.*, 527(1):33-48 (ENG).
7. L.Forti, M.Bossi, A.Bergamaschi, A.Villa & A.Malgaroli (1997). "Loose-patch recordings of single quanta at individual hippocampal synapses". *Nature*, 388:874-878 (ENG).
8. L.Forti, A.Tottene, A.Moretti & D.Pietrobon (1994). "Three novel types of voltage-dependent calcium channels in rat cerebellar neurons", *J*

Neurosci., 14: 5243-5256 (ENG).

9. L.Forti & D.Pietrobon (1993). "Functional diversity of L-type calcium channels in rat cerebellar neurons", *Neuron*, 10: 437-450 (ENG).
10. L.Galgani, C.Angaroni, L.Forti, A.Giorgilli & F.Guerra (1989). "Classical Electrodynamics as a nonlinear dynamical system", *Physics Letters A*, 139:221-230 (ENG).