



Paolo Massobrio

Associate professor

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Education and training

2008

PhD in Bioengineering Robotics Materials Engineering. Cv. Bioengineering and Bioelectronics

In vitro neuronal networks computational models and synaptic plasticity studies

University of Genova - Genova - IT

2004

Master degree in Biomedical Engineering

Cultured Neurons coupled to microtransducers modeling the neuro-electronic junction - 110/110 cum laude

Univeristy of Genova - Genova - IT

Academic experience

2016 - ONGOING

Assistant Professor (RTD B)

University of Genova - Genova - IT

2014 - 2016

Assistant Professor (RTD A)

Univeristy of Genova - Genova - IT

2008 - 2014

Post-doctoral fellow

Univeristy of Genova - Genova - IT

Language skills

Enrekang

Teaching activity

Holder of the following courses:

- **Computational Neuroscience** (2012-now) for the students of the 2nd year of the master degree in Bioengineering (University of Genova, Genova, Italy).

Co-holder of:

- **Bioelectronics** (2014-now) for the students of the 2nd year of the bachelor degree in Biomedical Engineering (University of Genova, Genova, Italy).
- **Neuroengineering and Computational Neuroscience** (2009-2011) for the students of the 1st year of the master degree in Bioengineering (University of Genova, Genova, Italy).

Teaching assistant of the following courses:

- **Bioelectronics** (2005-2014) for the students of the 2nd year of the bachelor degree in Biomedical Engineering (University of Genova, Genova, Italy).
- **Methods and Techniques for the Neuroengineering** (2004-2009) for the students of the 1st year of the master degree in Bioengineering (University of Genova, Genova, Italy).
- **Fundamentals of Neuroengineering** (2004-2006) for the students of the 1st year of the master degree in Biomedical Engineering (University of Pavia, Pavia, Italy).

Postgraduate research and teaching activity

Supervision of PhD students, residents and post-doctoral fellows

Currently, **I am supervising one PhD** student and 2 master students. Additionally, since 2004 I supervised

- 3 PhD students (University of Genova, Genova, Italy)
- 3 post-doc (University of Genova, Genova, Italy)
- 10 master students in Bioengineering (University of Genova, Genova, Italy)
- 55 bachelor students in Biomedical Engineering (University of Genova, Genova, Italy)
- 2 bachelor students in Biomedical Engineering (University of Cagliari, Cagliari, Italy)
- 1 master student in Biochemistry and Biotechnology (Universiteit Antwerpen, Antwerp, Belgium)

PhD committees membership

Member of the PhD Committee of Bioengineering and Robotics, Univ. of Genova (2014-now)

Postgraduate (PhD) teaching activity

- **Modeling neuronal structures** (2011-2015; 2017-now) for the PhD students of Bioengineering and Robotics.

Research interests

My research activities fit into the field of **Neuroengineering**, concerning both experimental and modeling aspects. Within this framework, my research interest are mainly focused on the following topics:

- Computational models of large-scale neuronal networks
- Engineered neuronal networks, and experimental studies on network dynamics and plasticity
- Bioelectronic models of the neuro-electronic junction

Here below, a brief description of my current research topics is summarized.

(i) Functional connectivity in large-scale neuronal networks

I have been working on the development of statistical algorithms to efficiently and accurately infer functional connectivity in large-scale neuronal networks. In particular, I focused my research on correlation- and information theory-based techniques which have been validate on ad hoc computational models (developed by myself) and later used to extract topological properties of dissociated neuronal assemblies coupled to MEAs. One of the most relevant results has been the development of a new version of the cross-correlation algorithm able to identify both excitatory and inhibitory links.

(ii) Interplay between dynamics and connectivity

Understanding the interplay between structure and function, as well as dynamics and connectivity of neuronal circuits are a challenge of the modern computational neuroscience.

I have been studying the interplay between network topology and spontaneous dynamics within the framework of self-organized criticality (SOC). The obtained results support the hypothesis that the emergence of critical states occurs in specific complex network topologies. By combining multi-electrode recordings of spontaneous activity of in vitro cortical assemblies with theoretical models, I demonstrate that different 'connectivity rules' drive the network towards different dynamic states.

(ii) Engineered neuronal networks.

The use of MEAs allow to drive the connectivity of neuronal networks and design peculiar configurations (e.g., 3-dimensional networks) where topological features can be defined a priori. In 2014, we published the first paper available in the literature where we developed a new experimental protocol for culturing in vitro 3D networks coupled to MEAs and investigate how a 3D organization can shape the emergent dynamics (paper J6). Thanks to a collaboration with Philips (Eindhoven, The Netherlands), in 2012 I developed an in vitro system for the study of the interactions (dynamics and functional connectivity) between the cortical and thalamic neurons. Starting from this results (we got the cover of Journal of Neuroengineering), I am currently working on the development of a new experimental platform able to selectively interface three interacting neuronal populations (i.e., cortical-thalamic-striatal neurons).

Grants

2012 - 2015

Linking biological and artificial neuronal assemblies to restore lost brain functions towards the design of innovative bi-directional neuroprostheses (BRAIN BOW)

FP7 - FET Young explorers Contract N. 284772 - IT

226 k/3 years - Principal investigator

2009 - 2012

Molecular Mechanisms and Structural Changes Required for Memory Persistence From Invertebrates to Mammals

Compagnia di San Paolo - IT

75 k/3 years - Principal investigator

Editorial activity

Member of the Editorial Board:

Scientific Reports

Frontiers in Computational Neuroscience

Computational Intelligence and Neuroscience

Frontiers in Physiology, Bioengineering and Biotechnology

Neuroscience Journal

Reviewer of:

Scientific Reports, IEEE Transactions on Biomedical Engineering, IEEE Transaction on Neural Networks, Journal of Neural Engineering, Biosensors & Bioelectronics, Neurocomputing, PLoS Computational Biology, PLoS ONE, Sensors & Actuators B, Frontiers in Human Neuroscience, Biomedical Microdevices, Frontiers in Neuroscience, Neuroinformatics, Annals of Biomedical Engineering.

Scientific evaluator of:

Future and Emerging Technologies (FET scheme); United States-Israel Binational Science Foundation (BSF); Swiss National Science Foundation (FNSNF); Research Foundation Flanders (FWO); Alzheimer Association; European Research Council (ERC).

Assignments abroad

none

Other professional activities

none