Nicolò Meneghetti

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PERSONAL INFORMATION

- Citizenship: Italian
- Date and place of birth: Sept. 15th 1993, Albenga (SV), Italy
- Address: Via Roma 9/7 Pisa (PI), 56126, Italy

EDUCATION

- **10/2019-TODAY** **PH.D. CANDIDATE**
  - The Biorobotics Institute, Sant'Anna School of Advanced Studies
  - Supervisor: Dr. Alberto Mazzoni
  - Tutor: Prof. Silvestro Micera
  - Thesis outline: My Ph.D. thesis concerns the investigation of the mechanisms behind the rythmogenesis of gamma activity in rodents' visual cortex. Specifically, I am combining data analysis, machine learning, information theory, and computational simulations with the goal of (i) investigating the proprieties of gamma oscillations in the primary visual cortex; (ii) exploring the potential of gamma activity as a biomarker for probing the mechanisms of cortical functions and, more interestingly, dysfunctions. The observation of the features of gamma oscillations proprieties can indeed be useful to reconstruct the underlying pathological synaptic and neuronal dysfunctions. During my Ph.D. I have investigated the alterations of visual gamma activity both in healthy rodents and in pathological conditions such as epilepsy, migraine, and glioma.
  - Keywords: gamma oscillations, mice, information theory, computational neuroscience, glioma, migraine, epilepsy

- **10/2016-04/2019** **MASTER'S DEGREE**
  - Master's degree in Bionics Engineering
  - University of Pisa and Sant'Anna School of Advanced Studies
  - Final mark: 110/110 cum laude
  - Supervisor: Prof. Silvestro Micera and Dr. Alberto Mazzoni

EDUCATION

- Final Thesis: Ultrasound modulation of neural activity of leech and zebrafish
- Thesis summary: Ultrasound (US) has received widespread attention as an emerging technology for non-invasive targeted neuromodulation alternative to electrical-based approaches. Further research, however, is still needed to fully characterize the effects through which US can excite/inhibit neurons as well as modulate central nervous system (CNS) activity. To address these scientific questions, my Master's thesis focused on the data analysis of two different experiments, both using low-intensity US stimulation, at two different levels of granularity. The first one consists of the analysis of individual neuron response, recorded through intracellular electrodes, of *ex-vivo* N cell medicinal leech (Hirudo medicinalis). The second, instead, concerns an *in vivo* exploration of the spatiotemporal patterns of the CNS obtained by employing wide-field optical imaging of calcium signals in transgenic larval stages of zebrafish (Danio Rerio).
- Keywords: wide-field, calcium imaging, electrophysiology, LIFU, zebrafish, leech, ultrasound, neuromodulation

- **10/2013-10/2016** **BACHELOR'S DEGREE**

- Bachelor's degree in Biomedical Engineering
- University of Genoa, Genoa
- Final mark: 100/100 cum laude
- Supervisor: Prof. Marco Storace
- Final Thesis: Implemetation of a two-compartment model of pyramidal neuron on a microcontroller
- Thesis summary: The thesis objective was to implement on a microcontroller firmware a two-compartment pyramidal neuron model in bursting activity mode. Preliminarily, the model was implemented in Matlab and tested in different operational conditions. Once implemented in the microcontroller firmware, the same tests were performed measuring with an oscilloscope the change in potential of some output pins, set to emulate the neural soma and dendrites. The system of differential equations describing the model was solved via the Euler method and implemented in the microcontroller firmware in C language.
- Keywords: Microcontroller, firmware, neuron model, Matlab, C

- **09/2007-07/2012** **HIGH SCHOOL DIPLOMA**

- High School Scientific Diploma (P.N.I. Piano Nazionale Informatica)
- Liceo Scientifico Giordano Bruno, Albenga (SV), Italy
- Final mark: 100/100

ACADEMIC EXPERIENCES

- **10/2022-TODAY**

VITISING PH.D STUDENT AT UNIVERSITY OF OSLO

- CINPLA Lab of University of Olso
- Visiting (expected to end on 12/2022) Ph.D. student under the supervision of Prof. Gaute Einevoll and Prof. Marianne Hafting-Fyhn
- Research purposes: Investigating the biophysical mechanisms behind the generation of local field potentials (LFP) in the cerebral cortex. Additionally, exploring the contribution of different interneuron types in the generation of the LFPs in mouse primary visual cortex
- Main activities: Computational neuroscience simulations based on Python scripts and data analysis in Matlab and Python

- **07/2019–10/2019**

POST LAUREAM SCHOLARSHIP

- The Biorobotics Institute, Sant'Anna School of Advanced Studies
- Post lauream scholarship on "Innovative methods in neuroprosthetics"
- Main acitivities: Data analysis in Matlab and ImageJ

- **06/2018–04/2019**

INTERSHIP AT THE BIOROBOTICS INSTITUTE

- The Biorobotics Institute, Sant'Anna School of Advanced Studies
- Intership under the supervision of Prof. Silvestro Micera and Dr. Alberto Mazzoni for Master's Degree thesis-related activities
- Main acitivities: Data analysis in Matlab and ImageJ

- **12/2018**

EXPERIMENTAL SESSIONS AT LENS

- European Laboratory for Non-linear Spectroscopy (LENS), Florence
- Experimental recording sessions of calcium imaging data on larval stages of zebrafish (Master's Degree thesis-related activity)
- Main activities: data aquisition with fluorescence microscope, sample preparation, calcium imaging video analysis

- **02/2018–06/2018**

LAB TRAINING AT "E.PIAGGIO" CENTER AND CNR

- Research center "E. Piaggio" and the National Research Council
- Lab training under the supervision of Prof. Nicola Vanello
- Research purposes: Estimating time-varying connectivity metrics of mice electrocorticogram data. Directed causal functional interactions were investigated within the Granger Causality framework. Specifically, time-varying autoregressive models were estimated by employing a Kalman filter
- Main activities: data analysis in Matlab

ACADEMIC EXPERIENCES

- 12/2017

VISITING RESEARCH FELLOW AT SISSA

- Inernational School for Advanced Studies (SISSA), Trieste
- Research colloboration period partially spent as a visiting research fellow at SISSA (Trieste) under the supervision of Prof. Vincent Torre, and partially at The Biorobotics Insutute (Pontedera) under the supervision of Dr. Alberto Mazzoni
- Research purposes: Analysis of neuronal network dynamics of *in vitro* models: comparison of emergent properties of spontaneous electrical activity in intact and dissociated neuronal slices recorded by means of calcium imaging recordings
- Main activities: data analysis in Matlab and ImageJ

- 03/016–10/2016

INTERSHIP AT DITEN OF UNIVERSITY OF GENOA

- University of Genoa, Genoa
- Intership at the COMPsys group (Complex Systems: Nonlinear Models and Circuits) led by Prof. Marco Storace, for Bachelor's Degree thesis related activities.
- Main activities: Firmware coding in C language, data analysis in Matlab, oscilloscope data aquisition

TEACHING SUPPORT ACTIVITY

- 2020-TODAY

TEACHING ASSISTANT OF PH.D. COURSE

- The Biorobotics Institute, Sant'Anna School of Advanced Studies
- Support in the teaching of the Ph.D. course "Information theory and neural modelling for neural engineering" held by Dr. Alberto Mazzoni
- Main activities: Preparation of and frontal support with hands-on experiences written in Matlab Live scripts

- 06/2022

SEMINAR FOR PH.D. COURSE IN DATA SCIENCE

- Palazzo Toscanelli , Sant'Anna School of Advanced Studies
- Seminar concerning the potential use of machine learning in political science for the PhD Course in Data Science and in Law "Big data in the public sector" held by Prof. Francesca Biondi

- 2021-2022

MASTER'S THESIS TUTORING

- The Biorobotics Institute, Sant'Anna School of Advanced Studies
- Master's thesis tutoring of 3 Physics students: "In Silico model of Neuron-Glia Interaction"; "Role of diverse neuronal subtypes in cortical network oscillations"; "Path Toward Epilepsy"

PUBLISHED JOURNAL ARTICLES

1

SYNAPTIC ALTERATIONS IN VISUAL CORTEX RESHAPE CONTRAST-DEPENDENT GAMMA OSCILLATIONS AND INHIBITION-EXCITATION RATIO IN A GENETIC MOUSE MODEL OF MIGRAINE

Meneghetti, N., Cerri, C., Vannini, E., Tantillo E., Tottene, A., Pietrobon, D., Caleo, M., Mazzoni, A.

The Journal of Headache and Pain (**2022**)

https://doi.org/10.1186/s10194-022-01495-9

2

ENVIRONMENTAL ENRICHMENT COUNTERACTS THE EFFECTS OF GLIOMA IN PRIMARY VISUAL CORTEX

Di Castro, M.A., Garofalo, S., De Felice, E., **Meneghetti, N.**, Di Pietro, E., Mormino, A., Mazzoni, A., Caleo, M., Maggi, L., Limatola, C.

Neurobiology of Disease (**2022**)

https://doi.org/10.1016/j.nbd.2022.105894

3

DISRUPTION OF LAYER-SPECIFIC VISUAL PROCESSING IN A MODEL OF FOCAL NEOCORTICAL EPILEPSY

Panarese, A., Vissani, M., **Meneghetti, N.**, Vannini, E., Cracchiolo, M., Micera, S., Caleo, M., Mazzoni, A., Restani, L.

Cerebral Cortex, bhac335 (**2022**)

https://doi.org/10.1093/cercor/bhac335

4

NARROW AND BROAD GAMMA BANDS PROCESS COMPLEMENTARY VISUAL INFORMATION IN MOUSE PRIMARY VISUAL CORTEX

Meneghetti, N., Cerri, C., Tantillo, E., Vannini, E., Caleo, M., Mazzoni, A.

Eneuro, 8(6) (**2021**)

https://doi.org/10.1523/ENEURO.0106-21.2021

5

DIRECT ACTIVATION OF ZEBRAFISH NEURONS BY ULTRASONIC STIMULATION REVEALED BY WHOLE CNS CALCIUM IMAGING

Meneghetti, N., Dedola, F., Gavryusev, V., Sancataldo, G., Turrini, L., de Vito, G., Tiso, N., Vanzi, F., Carpaneto, J., Cutrone, A., Pavone, F.S., Micera, S., & Mazzoni, A.

Journal of Neural Engineering, 17(5), 056033. (**2020**)

https://doi.org/10.1088/1741-2552/abae8b

6

THE ROLE OF NETWORK ARCHITECTURE IN THE ONSET OF SPONTANEOUS ACTIVITY

Pozzi, D., Meneghetti, N., Roy, A., Pastore, B., Mazzoni, A., Marsili, M., & Torre, V.

STEMedicine, 1(1), e1-e1. (**2020**)

https://doi.org/10.37175/stemedicine.v1i1.1

PUBLISHED JOURNAL ARTICLES

7

ULTRASOUND STIMULATIONS INDUCE PROLONGED DEPOLARIZATION AND FAST ACTION POTENTIALS IN LEECH NEURONS

Dedola, F., Severino, F. P. U., Meneghetti, N., Lemaire, T., Cafarelli, A., Ricotti, L., Menciassi, A., Cutrone, A., Mazzoni, A., Micera, S.

IEEE open journal of engineering in medicine and biology, 1, 23-32. (**2020**)

https://doi.org/10.1109/OJEMB.2019.2963474

CONFERENCE PROCEEDINGS

1

ALTERATIONS OF VISUAL CORTICAL ACTIVITY IN A GENETIC MOUSE MODEL OF MIGRAINE

Meneghetti, N., Cerri, C., Vannini, E., Tantillo, E., Tottene, A., Pietrobon, D, Caleo, M., Mazzoni, A.

FENS (Federation of European Neuroscience Societies) forum (**2022**)

Proceedings N/A

2

WHAT DETERMINES THE FREQUENCY AND THE DURATION OF INTERMITTENT EPILEPTIC EPISODES IN LOCAL CORTICAL NETWORKS?

Meneghetti, N., d'Alba, F., Mannella, R., Mazzoni, A.

31th Annual Computational Neuroscience Meeting (**2022**)

Proceedings N/A

3

A NETWORK MODEL FOR MIGRAINE-DRIVEN ALTERATIONS IN THE CONTRAST SENSITIVITY OF RODENT VISUAL CORTEX

Meneghetti, N., Mazzoni, A.

30th Annual Computational Neuroscience Meeting (**2021**)

Proceedings CNS*2021

4

FUNCTIONAL CONNECTIVITY BETWEEN EEG TOPOGRAPHICAL MAPS AND MUSCLE SYNERGIES WHILE USING AN UPPER LIMB EXOSKELETON

Meneghetti, N., Losanno, E., Ballanti, S., Peperoni, E., Astarita, D., Pirondini, E., Pierella, C., Vallone, F., Riener, R., Micera, S.

10th International IEEE/EMBS Conference on Neural Engineering (NER) (**2021**)

Proceedings NER 2021

CONFERENCE PROCEEDINGS

5

AN INTEGRATE-AND-FIRE MODEL OF NARROW BAND MODULATION IN MOUSE VISUAL CORTEX

Meneghetti, N., Mazzoni, A. (2020).
29th Annual Computational Neuroscience Meeting (**2020**)
Proceedings CNS*2020

6

ULTRASONIC NEURAL STIMULATION OF ZEBRAFISH LARVAE REVEALS REGION-SPECIFIC CALCIUM IMAGING ACTIVATION PATTERNS

Meneghetti, N., Dedola, F., Gavryusev, V., Sancataldo, G., Turrini, L., de Vito, G., Tiso, N., Vanzi, F., Carpaneto, J., Cutrone, A., Pavone, F.S., Micera, S., & Mazzoni, A.
VII Congress of the National Group of Bioengineering (GNB) (**2020**)
4 page conference paper available in ISSN: 2724-2129

HONORS AND AWARDS

- 12/2021

"TALENTO PLUS" AWARDED BY FONDAZIONE TALENTO ALL'OPERA ONLUS

A merit-based award dedicated to meritorious Ph.D. students of Sant'Anna School of Advanced Studies

- 09/2019

"VINCENZO TAGLIASCO" UNVERSITY OF GENOA AWARD

A merit-based award for best Master's thesis granted by the Italian National Group of Bioengineering (11 winners out of 102 candidates)

- 11/2016

SCHOLARSHIP AWARDED BY "FONDAZIONE PRETTO CASSANELLO"

A merit-based scholarship (1500€) awarded by "Fondazione Pretto Cassanello" to meritorious students graduated in the University of Genoa

SCIENTIFIC REVIEWS

Reviewer for "Medical & Biological Engineering & Computing" (IF 3.07) and "eNeuro" (IF 4.36)

THIRD MISSION

- Scientific dissemination activities in the context of the Open Day of the Biorobotics Institute (San Faustino) and the IIT-SSSA workshop (Italian Institute of Technology and Sant'Anna School of Advanced Studies).
- Guide of the Bioelectronics and Bioengineering Area activities at the Biorobotics Institute for several visiting hosts, such as for high school students or during the event "STEM – ragazze in gioco"
- Co-organizer of several virtual lab meetings jointly held with the Translational Neural Engineering lab (EPFL)
- Divulgative interview for dissemination of published paper (YouTube Link)

Oslo, November 4th 2022