

Proposals for Internships – Teachers affiliated to the Master Course of Biotechnology for Neuroscience and/or to the Department of Neuroscience

Prof. Martina Amanzio, Department of Psychology
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Effects of pandemic distress detected through neuropsychological assessment and polygraphic neurophysiological modulation in healthy ageing subjects.

Discipline: Cognitive Neuroscience

The trainees will be able to participate in the assessment of healthy ageing subjects, data collection and analysis at the Laboratory of the Department of Psychology, UNITO, with the collaboration of the R.G. of Pr. Amanzio, in order to evaluate:

- General and specific information about the pandemic period (e.g. lifestyle and health status, emphasizing possible SARS-CoV-2 infection);
- Global cognitive functioning and possible mood deflections through neuropsychological assessment;
- The long-term neuropsychological effects of pandemic distress will be further studied through an acquisition of psychophysiological parameters. Data will be collected for the evaluation of facial electromyography (EMG) (zygomatic and corrugator muscles), heart rate (by means of a blood volume pulse sensor - BVP) and skin conductance (by means of a galvanic skin response sensor - GSR)."

Prof. Marina Boido, Department of Neuroscience
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Morphological and morphometric analyses to study cell death and neuroinflammation in murine models neurodegenerative diseases.

The trainee will learn to collect different tissue samples (in particular nervous and muscular) from murine models, to process the samples (cryostat cutting, histological staining and immunofluorescence reactions) and analyze them using imaging techniques and specific softwares (for stereological counts and morphometric analyses)

Prof. Alfredo Brusco, Department of Medical Sciences
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Analysis of whole exome sequencing data and variants prioritization in a cohort of cases with neurodevelopmental disorders (NDD).

The possible pathogenic variants are validated by Sanger sequencing and segregated in family members. The research project aims at identifying novel genes which can be associated with autism spectrum disorders, intellectual disability or other (NDD).

Prof. Annalisa Buffo, Department of Neuroscience
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We'll be happy to host 2-3 trainees that will be involved in our research activities (see <https://www.nico.ottolenghi.unito.it/eng/Research/Research-Groups/Physiopathology-of-neural-stem-cells> for an overview). More in detail, they will be proposed to take part in one of the following projects:

1) *Novel Strategies for Cell-based Neural Reconstruction (position available immediately)*
Readings: doi: 10.1016/j.stemcr.2020.03.018

2) *Generation of human disease models to understand and treat pathology (position available immediately)*
Readings: doi: 10.1093/brain/awz139

3) *Uncovering the unfolding of mouse and human cell lineages through high throughput single-cell RNA sequencing in the cerebellum (position available from march 2022).*

Readings: doi: 10.1371/journal.pbio"

Prof. Elisa Carlino, Department of Neuroscience
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We are available to support internships in the field of psychophysiology and electrophysiology. In our laboratory it will be possible to see and learn the basics of electroencephalographic recording and participate in experimental studies in which pain, somatosensory perception, motor system, visual and auditory perception are investigated.

Prof. Franco Cauda, Department of Psychology
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FocusLab (FunctiOnal neuroimaging and Complex neUral Systems) is a research unit of the Department of Psychology of the University of Turin. It is led by Prof. Franco Cauda and Prof. Tommaso Costa. Our main topic of research is Pathoconnectomics. We therefore try to understand how the underlying structural, functional, and genetic properties of the healthy brain influence the development of brain pathologies. As a corollary of this, we also study the relationship among different disorders, trying to uncover their specific features that could allow to improve differentiation among diagnostic labels.

All our researches are based on Magnetic Resonance Imaging (MRI) data of human subjects, and we largely work on meta-analytic level.

Our approach is strongly methodological, and we therefore mostly develop new methods rather than applying pre-existing algorithms.

Most used software are: Matlab, FSL, Brain Voyager.

Prof. Adriano Chiò, Department of Neuroscience
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Proposed traineeships for the Neuroscience course, including possible projects for thesis:

1. Laboratory of Neurobiology and Neuropathology

Training in methodologies related to the study of neuropathological specimens (MS, ALS, brain tumors, stroke, and other neurological disorders): processing of autoptic and bioptical CNS samples (frozen and FFPE). Searching for biomarkers of neurological disorders in blood/CSF/urine samples from patients

2. Laboratory of advanced statistical methodologies for big data analysis

Training in the analysis of large databases (clinical, epidemiological/environmental, neuroimaging, nuclear medicine) using advanced methodologies.

3. Clinical trials management and laboratory

Participation to managing and conduction of clinical trials (Phase 1 to Phase 3) in the field of neurodegenerative diseases.

Prof. Massimo Collino, Department of Neuroscience

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Students will be involved in experimental procedures aimed to identify innovative pharmacological strategies for counteracting the deleterious effects of diet-induced metabolic derangements and the impact of diet modulation on the gut-brain axis. Molecular and biological approaches based on Western blot, rtPCR, immunohistochemistry, ELISA and colorimetric assays will be performed to assess the potential beneficial effects of the pharmacological tools on selective inflammatory signalling cascades involved in both neurogenic and metabolic inflammation.

Prf. Olga Dal Monte, Department of Psychology

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The internship's activities will focus on understanding the physiological and neural substrates involved in complex social behaviors. We address these questions utilizing interdisciplinary theoretical principles and behavioral, physiological (skin conductance, heart rate, and respiration frequency), and neurophysiological (electroencephalography) measurements to complement and extend our understanding of how the body and brain interact during complex social interactions. Taking a multi-pronged approach, the overall aim is to provide novel basic neuroscientific insights to better inform the mechanisms underlying social dysfunctions and, in the long run, to suggest novel treatments for neuropsychiatric disorders.

Prof. Ferdinando Di Cunto, Department of Neuroscience

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The main focus of our laboratory is the study of the genes implicated in genetic primary microcephaly and their possible role as targets for brain tumors treatment. To this aim, we analyze the effects of transient or stable alterations of genes' sequence and expression, on cell proliferation, differentiation, senescence and death, in tumor cell lines as well as in experimental tumors.

Prof. Carola Eva, Department of Neuroscience

Laboratory of Neuropsychopharmacology (Neuroscience Institute Cavalieri Ottolenghi)

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We are interested in understanding how the close link between genetic and environmental factors influence the neurobiology and behavioral performance and, eventually, the susceptibility to

neuropsychiatric disease. Our work combines behavioral and cognitive tests, immunological assays and neuroanatomical techniques in rodent models for different neurodisorders, and uses pharmacological approaches with the aim to establish new potential diagnostic and therapeutic strategies.

Prof. Ferdinando Fiumara, Department of Neuroscience
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Cellular and molecular mechanisms of polyQ expansion diseases

The thesis project will focus on the structural, molecular and cellular mechanisms that regulate the formation of pathological intracellular aggregates of proteins with expanded polyQ tracts, such as huntingtin in Huntington's disease, and on the possible modulatory role in these processes of compounds with potential therapeutic use. Approaches of bioinformatics, cell biology, molecular and confocal cell imaging will be employed.

Prof. Francesca Garbarini, Department of Psychology
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The traineeship at the Manibus Lab (Department of Psychology, University of Turin) will be focused on several topics in cognitive neuroscience (e.g. multisensory integration, motor control, body representation, defensive mechanisms; see <https://manibuslab.wixsite.com/manibus> for a detailed description of our research interests). The internship's activities can include design, acquisition, and analysis of experimental data acquired using physiological techniques, such as Transcranial Magnetic Stimulation (TMS), electroencephalography (EEG), electromyography (EMG), and the skin conductance response (SCR). Furthermore, the trainee can learn how to apply virtuality reality (VR) settings for neuroscience research.

Prof. Roberta Giordano, Department of Clinical and Biological Science
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Basic and specialized analyses of clinical biochemistry focused namely on neuroendocrinology aspects: knowledge and evaluation of the different phases of the total testing process. Innovative technologies for both high throughput automation and second-level specialized investigations: application to experimental studies for the implementation and clinical validation of new biomarkers, focused namely on neuroendocrinology aspects.

Prof. Maurizio Giustetto, Department of Neuroscience
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The students could be enrolled in one of the two following projects:

1) Assessing the cellular and molecular determinants of multisensory atypicalities in neurodevelopmental disorders caused by rare mutations (i.e.: Rett Syndrome and CDKL5 deficiency disorder).

The student will approach this topic by selecting one of the multidisciplinary approaches (e.g.: behavioral tests, neuroanatomy, electrophysiology, high resolution confocal imaging and connectomic analyses in both mouse and in-vitro models) currently in use in the laboratory.

2) EXPLOITING NEURONS- AND BRAIN-DERIVED EXOSOMES AS BIOMARKER FOR THE EARLY DIAGNOSIS OF PRODROMAL PARKINSON'S DISEASE:

the main aim of this thesis project is to search for multicomponent, non-invasive human biomarkers that can be used for differential early PD diagnosis. The student will approach this topic by learning how to: (i) isolate and purify Exosomes from bodily fluids or neuronal culture (including iPSC cells) serum; (ii) morphologically validate exosomes identity (using electron microscopy and nanosight imaging); (iii) analyze exosomes cargo (by using western blotting or Elisa assays).

Prof. Giuseppe Maina, Department of Neuroscience
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The contents of the possible internships are:

- 1) Clinical psychopharmacology: study design (with particular reference to the experimental design and the study method) and data analysis. Research areas: Bipolar disorder, Obsessive-compulsive disorder and ADHD in adults;
- 2) Neuropsychology: neuropsychological tests (creation and validation of software for neuropsychological investigations) and data analysis for their validation. Research Areas: Bipolar Disorder, Resistant and Refractory Depression, Obsessive Compulsive Disorder and Adult ADHD.

Prof. Giorgio Merlo, Department of Molecular Biotechnologies and Health Sciences
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Our laboratory is using human iPS cells to achieve genome mutations relevant for the cellular phenotype of Intellectual Disability. The cell models will be available in three months and need extensive characterization from cellular and molecular point of view.

Dr. Ivan Molineris, Department of Life Sciences and Systems Biology
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We propose to the interested students three different computational biology projects

1) Not Just Another RNAseq Pipeline (nJARP)

nJARP is an RNA-seq analysis pipeline that focuses on the integration of automatic state-of-the-art procedures and allows customizations in a reproducible and quick way, adhering to UNIX programming principles. This project is dedicated to the students that enjoyed these aspects of the course and want to deepen the knowledge of these arguments from an application point of view.

2) Artificial Intelligence for the study of Transcription Factor Binding Sites (AI4TFBS)

The students involved in this project will be introduced to Machine Learning (ML) computational approaches and will experiment with some of the published AI algorithms applied to the study of TFBS. The goal of the project is to find and master the most promising AI alternatives to the common MEME and HOMER tools.

3) The role of 3D DNA structure in RNA-DNA triple helices formation.

The aim of the project is to use computational prediction of 3D DNA structure and to investigate its relevance in the formation of lncRNA-DNA triple helices.

Prof. Tiziana Mongini, Department of Neuroscience
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Our Laboratory for Neuromuscular Diseases carries out prevalent diagnostic activity at the moment, of anatomic-pathological and biochemical type, but we are available for any internships of interested students; we also have the possibility to make clinical correlations with neuroimaging and biomarkers, as well as advanced therapeutic clinical trials for neuromuscular diseases.

Prof. Lorenzo Pia, Department of Psychology
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SAMBA research group (https://dippsych.campusnet.unito.it/do/gruppi.pl/Show?_id=hhuv) investigates a variety of topics within the domain of cognitive neuroscience (e.g., visuospatial representation, bodily self-consciousness, neurogastronomy, sport neuroscience, dog cognition) by means of state-of-the arts techniques/approaches (e.g., behavioral paradigms, neuropsychology, neuroimaging, virtual reality, electrophysiology). The internship typically includes hands-on training in laboratory techniques, actual research activities, lab meetings/journal clubs, students' supervision and so on.

Dr. Fabrizio Pizzagalli, Department of Neuroscience
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My research work focuses on Imaging Genetics (NeuroImaging studies and genetic associations) for understanding the biological mechanism and human brain changes in healthy subjects and neurodegenerative diseases. I am collaborating with the Imaging Genetics Center (IGC, <https://igc.ini.usc.edu/>), University of Southern California, Los Angeles, aiming to investigate new biomarkers describing the brain folding in humans. In this context, I am involved in different ENIGMA working groups (<https://enigma.ini.usc.edu/>).

Please find below a list of ongoing projects. **Feel free to contact me if you'd like to work on any of them.** Of course there will be the possibility to collaborate on more than one project, upon your time and interests.

1. Genotypes-to-phenotype prediction

Imaging genetic study focused on applying an existing bayesian model to predict phenotypes from genotypes.

Collaboration with Dr. Marco Lorenzi (Antibes, Fr).

Very nice opportunity to spend 2 or 3 months in Antibes.

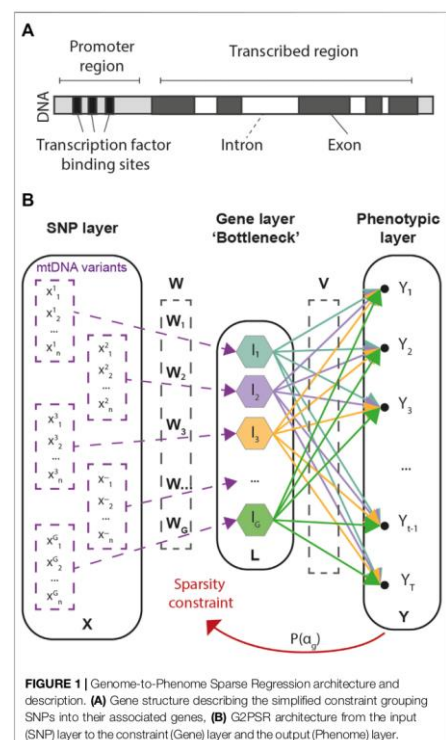
Front. Mol. Med, 30 March 2022

Sec. Bioinformatics and Artificial Intelligence for Molecular Medicine

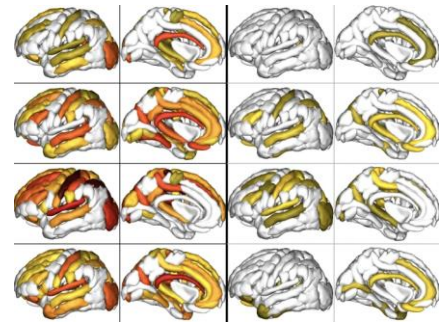
<https://doi.org/10.3389/fmmed.2022.830956>

2. Reliability of MRI-derived metrics

Assess the robustness of different neuroimaging



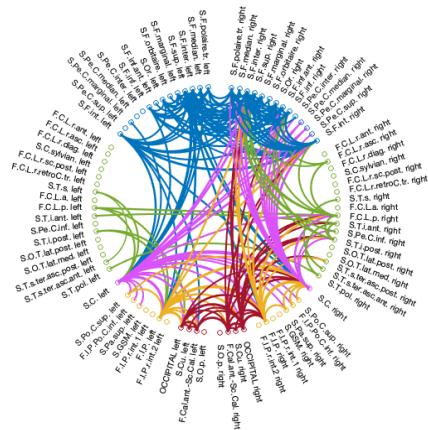
softwares segmenting many brain cortex biomarkers.
 Collaboration with Dr. Alex Crimi
 (SanoScience team, Krakow)



3. Pleiotropy network analysis

Apply **graph theory** for studying the genetic overlap of human brain biomarkers across the whole cortex. For this project, the Adolescent Brain Cognitive Development (ABCD) Study® (<https://abcdstudy.org/>) will be used. ABCD is the largest long-term study of brain development and child health in the United States. It includes more than 10.000 subjects, with:

- MRI multimodal data (functional and structural).
- genetic data.
- behavioural scores.
- many other variables of interest.
- longitudinal data.



4. Alzheimer's Disease prediction

Machine Learning methods + NeuroImaging for Alzheimer's Disease prediction. The ADNI large, and longitudinal, dataset (<https://adni.loni.usc.edu/>) will be used.

5. Genetics of Parkinson's Disease

The Allen Human Brain Atlas (<https://portal.brain-map.org/>) will be used to extract the gene expression of subcortical structures using ad-hoc brain atlases and GSEA analysis. Collaboration with Dr. Michel Dojat (University of Grenoble).

6. Human brain mapping platform

Developing a web platform able to automatically analyze MRI multimodal data. We will:

- Use Next.is web app
- Wrap up neuroimaging softwares using Docker and Singularity containers
- Work with GitHub and GitLab
- Build neuroimaging workflows using NiPipe
<https://nipype.readthedocs.io/en/latest/interfaces.html>



Prof. Paolo Provero, Department of Neuroscience
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Our lab develops computational approaches to the study of gene expression and regulation. We are especially interested in how the evolution and variation of regulatory sequences, at both the transcriptional and post-transcriptional level, impact human phenotypes. In the near future we plan to concentrate in particular on quantitative traits extracted from structural and functional brain MRI.

Prof. Innocenzo Rainero, Department of Neuroscience
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We welcome students of the Biotechnology for Neuroscience master's degree course with the possibility of verifying all the procedures used in the early diagnosis of dementia (biomarkers on CSF, neuropsych test, MRI, PET, etc.)

Prof. Paola Rocca, Department of Neuroscience
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Students could assist investigators who carry out neuropsychological tests to evaluate cognitive functions such as attention, processing speed, etc. in patients suffering from schizophrenia or bipolar disorder. For the acquisition and analysis of magnetic resonance neuroimaging we rely on the Neuroimaging Center of the PO Molinette.

Prof. Benedetto Sacchetti Department of Neuroscience
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Educational objectives: The internship aims to provide the main theoretical and practical knowledge aimed at the study of the processes of learning and memory. These processes will be addressed with a multidisciplinary approach, which includes techniques of behavioral analysis, opto- and chemogenetics and molecular biology ex vivo. Expected learning outcomes: At the end of the internship, the student will be able to know both from a theoretical and practical point of view the main methods of behavioral analysis and molecular biology used to study in vivo learning and memory processes. Program: Identify the main brain circuits and neuronal mechanisms involved in the formation of memories of emotionally salient events through immunohistochemical techniques, molecular biology, optogenetics e electrophysiological recordings.

Prof. Katuscia Sacco, Department of Psychology
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Techniques of cognitive stimulation with use of eeg and virtual scenarios.

All our themes are described on the site: <https://www.brainplasticity.net/>

Prof. Riccardo Soffiatti, Department of Neuroscience
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Participation and evaluation of clinical-translational studies in neuro-oncology. Participation in Brain Tumor Boards on adult and child neoplasms (also transnational within the European Network of Rare Solid Tumors, Euracan)

Dr. Serena Stanga, Department of Neuroscience
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We study the degenerative processes associated to healthy brain aging and neurodegenerative diseases, especially Alzheimer's disease (AD), Amyotrophic Lateral Sclerosis (ALS) and Spinal Muscular Atrophy (SMA). In particular we work on:

- mitochondrial morpho-functional dysfunctions in the CNS during aging and disease;
- iron metabolisms during brain aging and dementia;

- AD-related proteins functions and the impact on neurotrophic growth factors' release in both CNS and peripheral NS;
- In vitro neuromuscular junctions (NMJs) 2D reconstruction as a model to study the nerve-muscle interplay in motor neurons disorders;

The projects require to work with murine models of aging and disease hosted in the animal facility at NICO. Depending on the project and the time dedicated to research, trainees will approach to: mouse handling: Mouse breeding, genotyping, basic behavioral tests, mouse primary cell culture (neurons, astrocytes and myoblasts), nerve-muscle co-cultures, mouse spinal cord isolation; biochemical techniques: DNA and RNA extraction and dosage, SDS-PAGE and Western Blot, Mitochondria isolation; cell biology techniques: Cell culture (Fibroblasts, NSC34, C2C12, nerve-muscle co-cultures), Cell viability assay, Cell transfection, Immunocytochemistry and Immunohistochemistry, Confocal microscopy, Cytofluorimetric analysis (FACS); Molecular biology techniques: Classical PCR, RT-PCR, real-time PCR. Specific softwares: Office Pack, GraphPad Prism, Bio-Rad iQ5, Image J, MiNA.

Prof. Filippo Tempia, Department of Neuroscience
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The laboratory of "Neurophysiology of neurodegenerative diseases" studies animal models of neurologic and psychiatric disorders. The main focus is currently on the role the GSK3 kinase in depression and bipolar disorder. Neuronal activity is recorded by the patch-clamp technique in in vitro slices of cerebral cortex, to uncover the functional alterations and their ionic mechanisms. A second line of research regards a novel model of ataxia-teleangiectasia, a progressive and fatal neurodegenerative disease. The laboratory is located at NICO. Website: <https://www.nico.ottolenghi.unito.it/eng/Research/Research-Groups/Neurophysiology-of-neurodegenerative-diseases> Lab members: Filippo Tempia, Eriola Hoxha.