European School of Molecular Medicine

2025 summer call PhD selections

AVAILABLE POSITIONS

Principal Investigator	Mario Capasso, Lorenzo Chiariotti, Stefano Guido, Massimo Zollo
Affiliation	CEINGE Biotecnologie Avanzate Franco Salvatore
Title of the proposed project:	1) Deciphering the Impact of Non-Coding Somatic Mutations on Pediatric Cancer Epigenomes 2) Epigenetic players and alterations in brain tumors 3) From Genes to Therapies: Functional Genomics and Translational Strategies in Pediatric Brain Tumors and Neurogenetic Disorders 4) In vitro models to analyze the interactions between blood cells and endothelium in tumoral microenvironment
Short description of the project	1) The project aims to identify and characterize mutations in non-coding regulatory elements that alter transcriptional programs in pediatric cancers. The candidate will employ advanced genomic technologies (ATAC-seq, ChIP-seq, Hi-C, whole genome sequencing) and CRISPR-Cas9-based genome editing to mimic specific mutations. Functional and molecular techniques will be used to decipher the associated pathogenic mechanisms. The goal is to elucidate novel oncogenic processes and identify innovative therapeutic targets. 2) DNA methylation and epigenetic actors play a crucial role in the development and progression of brain tumours and may also drive the high heterogeneity typical of these cancers. The proposed project will investigate the role of pioneer factors and epigenetic modifiers in glioblastoma-derived cells, in glioblastoma cancer stem cells and in mouse models. Specifically, the project will focus on the role of the above factors in the epigenetic mechanisms of brain tumour development and progression, and their potential targetability for cancer therapy and overcoming drug resistance. 3) This research program explores the intersection of molecular oncology and neurogenetics, with a dual focus on pediatric brain tumors and genetic disorders affecting neurodevelopment. The central goal is to uncover how specific genetic alterations and signaling imbalances contribute to disease onset and progression, with the broader aim of translating these insights into therapeutic innovations. On the oncology front, studies concentrate on the molecular architecture of high-risk brain tumors—particularly Group 3 medulloblastoma—by dissecting the roles of tumor–stroma interactions, dysregulated pathways, and epigenetic modifications. These efforts are directed toward identifying actionable molecular targets that could inform precision treatment strategies. Parallel investigations in human genetics examine how mutations in key developmental genes—such as PRUNE1—disrupt fundamental processes like neuronal migration and synaptic organization. Functional studies are conducted to connect gene dysfunction with clinical phenotypes, helping to define pathogenic mechanisms in rare neurodevelopmental syndromes. A distinctive feature of this research is the emphasis on in vivo

	functional validation. Using murine disease models, candidate genes and therapeutic molecules are assessed for their impact on biological systems in a controlled, physiological context. This pipeline supports early-stage preclinical testing and advances drug discovery efforts, particularly in the development of targeted molecular therapies. In addition to genetic and pharmacological approaches, the program is also exploring the therapeutic potential of nutraceutical compounds. Novel formulations are being developed and tested in neurological and neurodegenerative disease models, with the goal of identifying bioactive compounds capable of modulating key molecular pathways involved in brain function, inflammation, and cellular resilience. These formulations are evaluated both in vitro and in vivo to assess efficacy, safety, and mechanism of action. By combining experimental tools from genomics, transcriptomics, bioinformatics, and cellular modeling, the research fosters a systems-level understanding of complex diseases. The integration of mechanistic insights with translational frameworks aims to bridge the gap between bench and bedside, offering new avenues for clinical intervention 4) Recent advances in microfabrication, such as bioprinting and soft-lithography, allow the creation of microchannel networks with complex three-dimensional structures, with considerable potential in the biomedical field. In particular, the use of microfluidic technologies makes it possible to reproduce the flow conditions of the microcirculation and to study their effects using cell biology methods. In this project, we intend to analyze the interactions between blood cells and endothelium in microfluidic platforms. A layer of endothelial cells will be grown by perfusion on the surface of the microchannels until confluence and subsequently blood samples with different hematocrit will be fed to the device. The interactions between corpuscular elements and endothelium will be studied using optical, confocal and immunofluorescence microscopy techniques. Among the main aspects of these interactions is margination, in which red blood cells tend to migrate towards the center of the microchannel, while less deformable components — such as white blood cells and platelets — move towards the walls. Margination can produce important mechanobiological effects, such as the formation of platelet aggregates or the trans-endothelial migration of white blood cells. Flow-induced interactions between blood cells and vascular walls are essential for the proper functioning of the circulatory system. A basic understanding of these mechanisms, with the support of artificial intelligence for big data analysis, not only sheds light on essential physiological processes, but also opens new perspectives for the diagnosis and treatment of vascular and tumor diseases.
Main research area for the project	Cancer biology

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