Who are we?
We are seventy university researchers engaged in the fight against neurodegenerative diseases and neurological disorders.

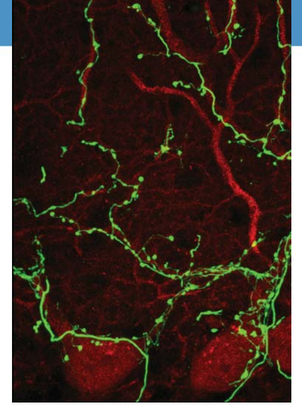
What do we do?
In order to repair the brain, it is imperative that we know how it works. We study the structure and function of the normal brain in order to unravel the mechanisms that underlie the pathogenesis of neural diseases and to discover new strategies to cure these disorders.

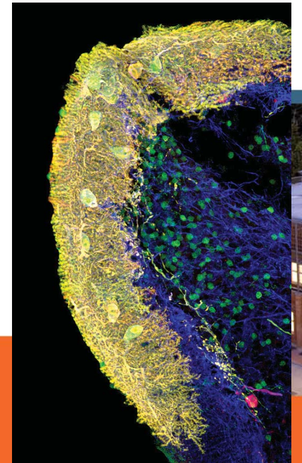
What is our mission?
A multidisciplinary approach is essential for understanding a highly complex organ like the brain. We focus in developing a multidisciplinary approach that combines the skills and expertise of our faculty, with the goal of integrating basic research and its clinical applications. NICO's mission is to facilitate the consolidation of the enormous wealth of knowledge that resides with our very talented faculty and to make efficient use of the expensive scientific equipment that was previously scattered in a variety of departments all over the university campus.

Disseminating scientific knowledge throughout the community
Our researchers are very dedicated to making sure that major research findings in neuroscience are made accessible to the public at large. As such, we support a number of community dissemination activities. In particular, we have the following outreach programs for high school students: UniStem Day, Neuroscience Olympic Games, and a Scientific Summer Academy. These and other initiatives are designed to introduce the students to neuroscience, to demonstrate and engender the commitment and passion that drives scientific research, and to explain the complex findings of neuroscience in a simple and reliable manner.

Why and how to support us
Alzheimer's, multiple sclerosis and ALS (amyotrophic lateral sclerosis) are the most commonly known neurodegenerative diseases, and many families are touched, directly or indirectly, by the burdens of these diseases. While we work to support patients afflicted by these disorders, we often forget that, as for other diseases or injuries of the nervous system, the development of novel and effective therapies is inevitably rooted in basic research. This kind of research is very rarely highlighted by the press, but it is fundamental for elucidating the mechanisms that underlie degenerative processes and for gaining insight into how these mechanisms can be applied to the repair and regeneration of neural tissues.

We welcome donations to sustain our research activities in general, or to support specific research projects. All donations will be appropriately acknowledged.





UNIVERSITÀ DEGLI STUDI DI TORINO

NICO

FONDAZIONE CAVALIERI OTTOLENGHI

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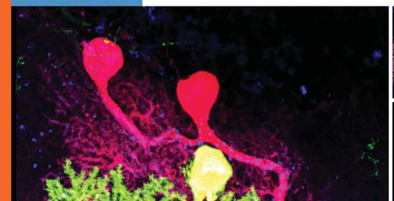
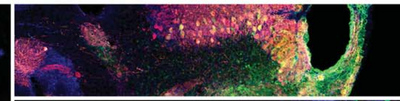
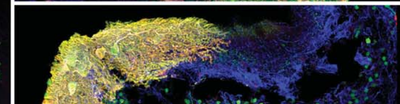






Eight highly collaborative research groups at our Institute:

Neurobiology of brain plasticity

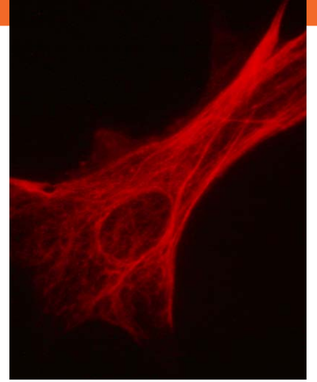
The ability of the adult central nervous system to repair itself following trauma, stroke or neurodegenerative diseases, and to recover the damaged functions is very limited. To promote repair and functional recovery we employ three complementary approaches: i) We study brain development to understand neural stem cells properties and functions, and to elucidate mechanisms of cell specification and integration. Based on such research, we develop models of cell replacement in pathologies such as cerebellar ataxia and Huntington's disease. ii) We investigate the role of glia and neural progenitors in physiology and pathology, in order to implement the neurosupportive/reparative properties of these cells in diseases such as stroke and multiple sclerosis. iii) We explore mechanisms that regulate the ability of neurons to reshape their connections, and the contribution of experience or rehabilitation in these processes and in the recovery of impaired functions.

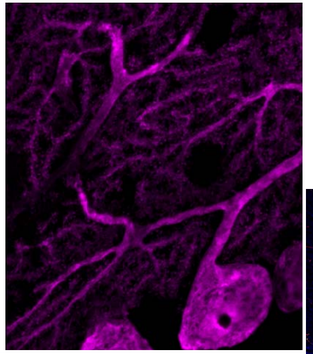
Brain development and disease

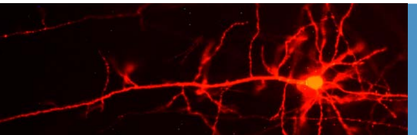
We study the development of the central nervous system in the brains of embryonic to elderly organisms, with the goal of uncovering neurobiological mechanisms and molecular pathways that drive development under normal conditions, but may go awry and lead to neurodegeneration in the diseased state. Our focus is on the cellular mechanisms that cause neuronal cell death and neuroinflammation, always with an eye towards how such insights can be leveraged to delay and prevent the progression of the destructive processes in experimental models of stroke, acute and chronic glaucoma, epilepsy, spinal cord injury, SMA and ALS, and Alzheimer's and Huntington's diseases. Our aim is to identify molecular targets that can be applied to develop novel therapeutics. We also work closely with clinicians to evaluate the immunomodulatory, neuroprotective and axonal growth-promoting roles of stem cells, to allow for rapid and effective translation of our findings from lab bench to the bedside. Our ongoing collaborations with biotech companies are aimed at developing innovative strategies to treat diseases of the nervous syste

Neurophysiology

One way to understand how interneuronal communication is affected by the disease process is to analyze their electrical activity: our efforts are aimed at revealing causative mechanisms that underlie some neurological and psychiatric disorders. In particular, we are interested in how electrical signals of neurons are altered in the brains of patients with Alzheimer's disease, and of those with the less known spinocerebellar ataxias (which are neurological disorders of the cerebellum that that lead to a progressive deterioration of coordination of movements, in some cases resulting in the complete loss of ability to walk). Currently no treatment exists that can stop irrevocable progression of these two diseases. Also, in collaboration with other laboratories, we have launched a research program on the causes and mechanisms of schizophrenia.





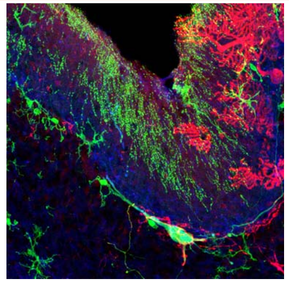


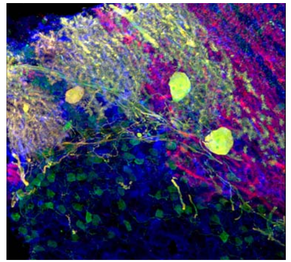
Clinical neurobiology

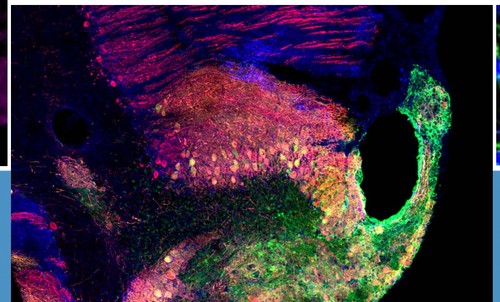
We are engaged in studying how to better diagnose and understand the causes of multiple sclerosis (MS), an profoundly debilitating autoimmune disease. We work closely with neurologists from CRESM, the Regional Reference Center for MS. Our research centers on clinical problems that are highlighted in patients at the Centre. We are particularly interested in MS-related issues, including: the development of diagnostic methods to differentiate MS from other diseases, early detection of patients who are non-responsive to therapies, and identification of biomarkers that can be used to predict disease progression and prognosis, the correct timing for administering drugs, the immunological changes that occur during pregnancy and the expression of genes involved in autoimmunity. CRESM has a biological bank where we collect and store biological samples (from patients with MS, with other neurological diseases, or from healthy controls), these samples are made available not only to our research, but also to investigators from national and international laboratories, to foster research on MS and other diseases.

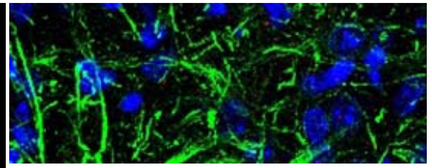
Adult neurogenesis

The discovery that new nerve cells can form from stem cells, even in the brain of an adult individual (neurogenesis) opens vast possibilities for new regenerative therapies, and raises the possibility that the injured brain may be able to 'naturally' replace lost cells. Stem cells are present in only two regions of the brain, but we have shown that similar cells originate new neurons also in brain areas that are commonly affected by neurodegenerative diseases (such as Alzheimer's, Huntington's, Parkinson's diseases, trauma, and stroke). This alternative source of neurogenesis is still not very heavily explored. However, it may provide new therapeutic applications related to the beneficial effects of that repairing nerves without replacing damaged cells, or the findings may impact research on areas of the brain involved in anxiety and depression. Our studies, as well as targeted therapies to promote cell repair/replacement, are aimed at identifying alternative ways in which neurogenesis can be leveraged to influence various disorders of the nervous system.









Neuropsychopharmacology

The nutritional and emotional stimuli to which an individual is exposed during the early stages of life influence his/her susceptibility to metabolic disorders and psychopathology in adulthood. We study the molecular mechanisms whereby the perinatal environment permanently changes the neural circuits that regulate emotion and energy balance. Clarifying such mechanisms is essential for understanding the pathogenesis of psychiatric disorders (anxiety and depression) and metabolic diseases (obesity and type 2 diabetes), which affect more than 100 million people worldwide. One line of research concerns the efficacy of pharmacological treatments and rehabilitation in preventing the effects of the postnatal vulnerability to emotional stress and nutrition, with the goal being to develop new therapeutic approaches to prevent and cure these diseases.

Nerve regeneration

Peripheral nerves participate in sensorimotor control in the whole body, and their injury, due to various kinds of accidents, can lead to important clinical problems. Our research on such injuries is being carried out in collaboration with orthopedics and neurosurgeons, and seeks to provide concrete answers in terms of how to develop novel strategies for therapy and rehabilitation. We emphasoze innovative methods of tissue engineering that will improve the reconstruction and regeneration of peripheral nerves. Working in close collaboration with members of the Politechnic of Torino, we are developing biomimetic biomaterials that can be used as an effective solution for the regeneration of nerve tissue in case of traumatic injury. We participate in numerous national and international research networks. With the BioHybrid Consortium (funded by the EU), we have developed a prosthesis for reconstruction of peripheral nerves that uses chitosan, a biomaterial derived from the shells of shellfish.

Neuroendocrinology

Hormones are among the most important environmental factors that influences the development, differentiation and functioning of the nervous system. We study the interactions between steroid hormones, neural circuits, and behaviors that are dependent on steroids: we believe that clarifying such interactions is essential for understanding the causes of some behavioral disorders (such as anorexia, depression) and some neurodegenerative diseases (such as Parkinson's disease and MS), that have a strong gender difference between the two sexes. Minimal alterations of hormonal balance - due to exposure to chemical compounds that interact with the receptors of these hormones - can induce harmful effects on the behavior and physiology of animals and man. Our studies are useful for determining acceptable threshold values and whether the exposure to environmental factors can lead to a malfunction. Indeed, one of our lines of research concerns the study of endocrine disruptors and the regulation of brain circuits that control reproduction and feeding behavior.