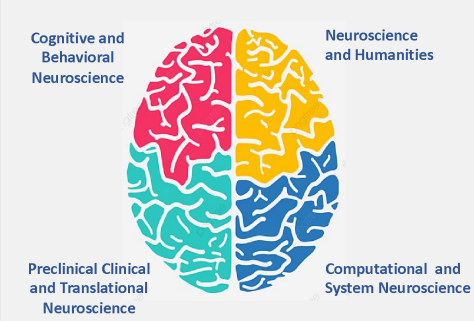
Theoretical and Applied Neuroscience

Research PhD Program



Cycle 42°

Academic year 2026-2027

List of the Research Topics

Curriculum	Research Project	Host Institution	Number of positions/ type
Curriculum 1: Cognitive and Behavioral Neuroscience			
1.1	Neuroplasticity and early language development in deaf and hard-of-hearing children	University of Padua	1 position without scholarship *subject to confirmation
1.2	Evolutionary Origins of the Mental Number Line: Investigating Spatial-Numerical Associations in Planarian Flatworms	University of Messina	1 scholarship
Curriculum 2: Neuroscience and Humanities			
2.1	Music and body: The contribution of body perception in music training and music therapy	Conservatorio Statale di Musica "E.F. Dall'Abaco" and University of Verona	1 Scholarship *Subject to confirmation
2.2	Interoception in stroke	IRCSS Ospedale Sacro Cuore Don Calabria e University of Verona	1 Executive position reserved to employees at IRCSS Sacro Cuore
2.3	Changing attitudes and actions towards Mafia-type criminal organizations through immersive virtual reality: Behavioural, psychophysiological and neuroscientific studies	Sapienza University of Rome - Department of Psychology	1 Scholarship *Scholarship funded in the framework of Horizon 2020 Framework Programme ERC AdG 2017 Project number: 789058 — CUP B86C18002710006*
Curriculum 3: Preclinical, Clinical and Translational Neuroscience			
3.1	To study the neurobiological, behavioral and pharmacological basis of drug addiction and related psychopathologies.	University of Camerino	2 Scholarship
3.2	Exploiting astrocytic GDNF in a gene therapy approach for Parkinson's disease and drug-resistant epilepsy	University of Ferrara	1 Scholarship
3.3	Personalized treatments of early-onset	Department of	1

	developmental encephalopathies caused by pathogenic variants in neuronal KCNQ genes	Neuroscience, University of Naples Federico II	Scholarship
3.4	Neurobiology and Neuropharmacology of Impulsivity, Attention Deficit Hyperactivity Disorder, and Substance Use Disorders	University of Camerino	1 Scholarship
3.5	Cortical circuits in neurodevelopmental and psychiatric disorders	*In cooperation with* Italian Institute of Technology	2 scholarships funded by foreign countries and reserved to CSC beneficiaries *subject to confirmation
3.6	Defining the role of neuromodulatory systems in sleep loss–induced susceptibility to addiction	University of Camerino	1 Scholarship *Scholarship in the framework of an initiative funded by the Giovanni Armenise Harvard Foundation - CUP: J14G20000440005
3.7	Psilocin-mediated modulation of microglial neuroinflammation in multiple sclerosis: an in vitro study on glia-oligodendrocyte crosstalk	University of Cagliari	1 scholarship
3.8	To study the neurobiological, behavioral and pharmacological basis of drug addiction and chronic pain: Focus on the opioid system.	University of Camerino	2 scholarships * 1 of the two positions is reserved to the specific agreements with Chinese Universities and is subject to confirmation
3.9	To evaluate the neurobiological mechanisms regulating NaCl and water intake in rodent models.	University of Camerino	2 scholarships
3.10	To study the role of the ghrelin system to develop new nutraceutical to treat depression and reward related disorders	Biotecnica/University of Camerino	2 Executive positions reserved to Biotecnica employees
3.11	Identification of the artery-brain circuit involved in aortic aneurism progression	Sapienza University of Rome - Department of Medico-Surgical Sciences and Biotechnologies	1 Scholarship *subject to confirmation
3.12	Investigating the neural circuit shaping vascular immune cells niche contributing to aortic aneurysm	Sapienza University of Rome - Department of Medico-Surgical Sciences and Biotechnologies	1 Scholarship *subject to confirmation
3.13	To evaluate the neurobiological mechanisms regulating bitter and sweet taste in rodent models.	University of Camerino	1 scholarship
3.14	To study neuronal network dynamics	Institute of Biophysics,	1

	in health and disease	CNR, Pisa	Scholarship * subject to confirmation
3.15	Unraveling the Pathophysiological Mechanisms of Friedreich's Ataxia to Enable Innovative Therapeutic Strategies	Institute of Neuroscience, DSBM-CNR	1 Scholarship * subject to confirmation
3.16	Uncovering CNS Pathophysiology in Pompe Disease: from Neurodevelopment to Neurodegeneration	Institute of Neuroscience, CNR	1 Scholarship *subject to confirmation
Curriculum 4: Computational and System Neuroscience			
4.1	Investigating the molecular and cellular functions of the autism-associated gene DDX53 using human brain organoids, multi-omics, and AI-driven computational modeling	University of Genoa	1 Scholarship *Funded by the project FIS-2024-07592 Multidimensional platform to investigate human genes associated with autism spectrum disorders. CUP: D53C25002320001. P.I. Marcello Scala. H.I.: University of Genoa.
4.2	Motor prediction and error observation	University of Bologna	1 scholarship
4.3	Computational Modeling of Reinforcement, Motivation, and Drug-Seeking Behavior in Rodents	University of Camerino	2 scholarships * 1 of the two positions is reserved to the specific agreements with Chinese Universities and is subject to confirmation
4.4	Development of Medical devices for e-Health and Innovative diagnostics for precision medicine	AM microsystem/University of Camerino	2 Executive positions reserved to Am-microsystem employees
4.5	Sensory Neurotechnologies for Standing, Balance, and Locomotion after Spinal Cord Injury	IRCCS Ospedale San Raffaele	1 Scholarship *Subject to confirmation
4.6	Personalized Peripheral Nerve Stimulation for Finger Dexterity Recovery in Stroke Patients	IRCCS Ospedale San Raffaele	1 borsa Scholarship *Subject to confirmation

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.1

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Neuroplasticity and early language development in deaf and hard-of-hearing children
ERC Field: SH4_1 Cognitive basis of human development and education, developmental disorders; comparative cognition; SH4_8 Language learning and processing (first and second languages); LS5_4 Sensation and perception (e.g. sensory systems, sensory processing, pain)
Key words: deafness / hearing impairment, speech perception, language development, neuroplasticity, developmental psychology
Host Institution: University of Padua
Reference person / supervisor: Judit Gervain (judit.gervain@unipd.it)
Research Topic Description:
Deaf and hard-of-hearing infants often have suboptimal and highly variable language developmental outcomes, often despite timely fitting with hearing aids or cochlear implants. Suboptimal language skills then have a cascading negative impact on education, professional choices, quality of life and integration to society. The reasons for individual variation and suboptimal outcomes are not always clear and persist even after controlling for known factors of variation such as level of hearing loss, duration of auditory and language deprivation, age of implantation, quality and quantity of rehabilitation and medical support etc. This project addresses the hypothesis that different language outcomes in deaf and hard-of-hearing children may be related to individual variation in brain plasticity, beyond the other known factors. To address this hypothesis, the project tests and follows up longitudinally the early speech perception and language learning abilities of deaf and hard-of-hearing infants and children. Non-invasive, infant-friendly brain techniques such as near-infrared spectroscopy (NIRS) and electroencephalography (EEG) as well as behavioral methods will be used to chart infants' speech perception and language learning abilities, and their underlying neural mechanisms to assess plastic changes in the brain due to auditory and speech deprivation, and the subsequent restoration of hearing. These will be related to subsequent language abilities (e.g. vocabulary size, syntactic complexity etc.) later in life.

Research Team and Environment:
The research project will be carried out at the Department of Developmental and Social Psychology (DPSS) of the University of Padua and the Audiology / ORL Ward of the Azienda Ospedale-Università Padova (AOUP). The PI's lab at the BabyLab at the DPSS is equipped behavioral and neuroimaging methods for infant and child testing. Through the recruitment system of the BabyLab, typically developing infants / children will be available for testing as controls. The deaf / hard-of-hearing infants will be recruited at the Audiology Ward of the AOUP. The PI's research team is an interdisciplinary group comprising BA, MA and PhD students as well as post doctoral fellows, with expertise ranging from linguistics and developmental psychology to speech therapy and biomedical engineering. The candidate will join this productive research group and will have the opportunity to interact with all group members, join weekly lab meetings and seminars, and can interact more broadly with the large developmental psychology community of the DPSS. The PI is also member of the Padova Neuroscience Center (PNC), an interdisciplinary research bringing together scholars from a broad range of disciplines such as neurology, cognitive and affective neuroscience, psychology, linguistics, mathematics, physics, computer science and other related disciplines. The candidate will be able to attend the talks, seminars and lectures organized by the PNC, will have access to the PNC's lab and other infrastructure (high density EEG, OPM-MEG etc.), can take courses from those offered by the Neuroscience PhD program of the PNC, and can interact synergistically with the entire PNC community from PhD students and post docs to faculty members.

Preferred Research Skills and Competence:
The candidate will receive training in cognitive developmental neuroscience, in particular in early language development, including the use of behavioral and neuroimaging techniques such as near-infrared spectroscopy (NIRS) and electroencephalography (EEG) in infants and young children. The ideal candidate will have a background in audiology and/or otorhinolaryngology, developmental neuroscience or related fields, possibly with clinical experience working with deaf / hard-of-hearing infants and children. Experience testing these populations in experimental studies is a plus.

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.2

Project title: Evolutionary Origins of the Mental Number Line: Investigating Spatial-Numerical Associations in Planarian Flatworms

ERC Field: LS5_5 Cognitive Neuroscience; LS5_8 Behavioural Neuroscience; LS8_1 Evolutionary Biology; SH4_6 Cognitive Basis of Human Behaviour

Key words: Mental Number Line, Numerical Cognition, Comparative Cognition, Planaria, Evolution, Spatial Representation, Bilateria, Behavioural Neuroscience

Host Institution: University of Messina

Reference person/supervisor: Carmelo Mario Vicario carmelo.vicario@unime.it

Research topic description

The Mental Number Line (MNL), namely the tendency to associate smaller numerosities with the left side of space and larger numerosities with the right side, is one of the most robust and extensively studied phenomena in numerical cognition. Originally considered a by-product of language, culture, and formal education, increasing evidence suggests that spatial-numerical associations may reflect an evolutionarily ancient cognitive mechanism. Studies conducted in human infants, non-human primates, birds, fish, and insects indicate that the mapping of numerical magnitude onto space may emerge independently of symbolic mathematics and linguistic experience.

Despite these advances, a fundamental evolutionary question remains unresolved: how far back in animal evolution can the origins of the Mental Number Line be traced? To date, no study has investigated whether number-space mappings can be detected in organisms possessing extremely simple nervous systems.

The present project aims to address this question using the planarian flatworm Schmidtea mediterranea. Planarians occupy a particularly informative position in animal phylogeny, representing among the simplest extant bilaterian organisms endowed with a centralized nervous system and cephalization. Their combination of bilateral body organization, relatively simple neural architecture, and demonstrated learning abilities makes them an ideal model for investigating the evolutionary roots of spatial-numerical cognition.

The project will examine whether planarians exhibit spontaneous or learned associations between numerical magnitude and spatial orientation. Using controlled behavioural paradigms, automated video tracking, and quantitative computational analyses, the study will determine whether numerical information is preferentially mapped onto specific regions of space.

The ultimate objective of this research is to determine whether the cognitive foundations of number-space mapping emerged early during bilaterian evolution. Demonstrating a Mental Number Line in planarians would provide important evidence that fundamental aspects of numerical cognition may predate the emergence of complex brains and advanced cortical architectures. Such findings would substantially advance current theories concerning the biological and evolutionary origins of abstract mental representations.

Research team and environment

This research project will be carried out at the Department of Cognitive Sciences, Psychology, Educational Sciences and Cultural Studies (COSPECS), University of Messina, Italy. The laboratory headed by Prof. Carmelo Mario Vicario is conceived as a multidisciplinary environment dedicated to investigating fundamental questions in cognitive neuroscience, comparative cognition, and behavioural science.

The main research focus of the laboratory is on the study of the neurobiological, cognitive, and evolutionary mechanisms underlying behaviour in humans and non-human organisms. Particular emphasis is placed on numerical cognition, spatial representation, learning, decision-making, embodiment, and the evolutionary origins of cognitive functions. A substantial part of the laboratory's activity is directed toward understanding how complex cognitive abilities emerge from simpler biological systems and identifying the fundamental principles that shape cognition across species.

The research team consists of researchers, post-doctoral fellows, and PhD students with complementary expertise in neuroscience, psychology, biology, behavioural science, and quantitative data analysis. The laboratory maintains active collaborations with national and international researchers working in cognitive neuroscience, comparative psychology, behavioural biology, and numerical cognition.

Researchers have access to dedicated facilities for behavioural experimentation, automated video-tracking systems, high-resolution video recording equipment, custom behavioural testing apparatuses, and advanced computational resources for quantitative behavioural analysis and statistical modelling. These facilities provide an ideal environment for the development of innovative experimental paradigms aimed at investigating numerical cognition in simple animal models.

Preferred Research Skills and Competences
The doctoral candidate will receive training/supervision in behavioural experimentation, comparative cognition, quantitative behavioural analysis, automated video tracking, experimental design, and advanced statistical methods.

Preferred Research Skills and Competences
Candidates with training backgrounds in neuroscience, psychology, biology, cognitive science, animal behaviour, biomedical sciences, computer science, mathematics, physics, engineering, or related disciplines are preferentially considered for this position. Previous experience in behavioural experimentation, quantitative methods, programming (e.g., R, Python, MATLAB), image analysis, or animal research will be considered advantageous.

Curriculum 2: Neuroscience and Humanities

Code 2.1

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Music and body: The contribution of body perception in music training and music therapy

ERC Field; SH4_3 Neuropsychology and cognitive psychology SH4_4 Clinical and experimental psychology; SH5_9 Music and musicology, history of music

Key words: Body perception; music training; music therapy; interoception; mind and body

Host Institution: Conservatorio E. Dall'Abaco, Verona; Università di Verona
Reference person/supervisors: Paolo Alberto Caneva, **paolo.caneva@conservatorioverona.it**
Valentina Moro , **valentina.moro@univr.it**

Research topic description: Interoception plays a critical role in generating and updating internal models of the state of the body to support adaptive physiological regulation, body representations and actions. A bidirectional interaction of external stimulation and interoception contributes to psychological health and well-being, emotional regulation and self-awareness. Music has long been used as a means of improving individual and collective well-being, but little is known about the interactions between music and the body's internal states. The project will investigate the effects of musical practice on the perception of the body's internal states, in terms of interoceptive sensitivity, accuracy, and awareness, with a specific focus on the potential that this interaction may have for music education and training programs, as well as for music therapy interventions in the context of neurological and psychiatric disorders.

Research team and environment
This research project will be carried out at the Conservatory E. Dall'Abaco, Verona, Italy and at the NPSY.Lab-VR (Department of Human Science, University of Verona. The two institutions have a long-standing history of collaboration in the field of music therapy, including a joint Master's degree program and several educational and research projects. A multidisciplinary approach allows researchers to investigate complex questions in cognitive neuroscience, with the integrated contribution of humanities (philosophy, antropology, sociology, psychology) and medical disciplines (rehabilitation, neurology, geriatrics). Expertise in music and music therapy enables the application of cognitive neuroscience paradigms in both therapeutic and educational settings. The team consists of several researchers, post-doctoral fellows and PhD students with different backgrounds including psychology, musicology, rehabilitation, philosophy. Researchers have access to the Conservatorio Dall'Abaco, NPSY.lab-Vr facility equipped buildings at the University of Verona- and the other laboratory

locations in the territory (AFMA, Verona and CEMS- Memory Center, Verona, Ospedale Maggiore Borgo Trento Verona, IRCSS Sacro Cuore Negrar).

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in music therapy, cognitive neuroscience and neuropsychology, including brain activity recording, imaging, electrophysiology, behavioural testing, virtual reality environment, and data analysis. Multidisciplinary, integrated approaches will be also experienced. Candidates with training backgrounds in music therapy, neuropsychology and rehabilitation, are preferentially considered for this position.

Curriculum 2: Neuroscience and Humanities

Code 2.2

Project title: Interoception in stroke

ERC Field SH4_4 Neuropsychology; SH4_5 Attention, perception, action, consciousness; SH4_2 Personality and social cognition, emotion; SH4_6 Learning, memory; cognition in ageing;; SH4_3 Clinical and health

Key words: Body Representation, Social interaction, Rehabilitation, Virtual environment

Host Institution: IRCSS Sacro Cuore Don Calabria - University of Verona
Reference person/supervisors: Elena Rossato, elena.rossato@sacrocuore.it
Valentina Moro , **valentina.moro@univr.it**

Research topic description: Our own body is an "object" of perception. We can perceive its shape, weight, temperature, and we have experience of it, as by feeling the body as ours, as distinct from that of others and objects. These body perceptions (BP) are mediated by neural body representations, fed by a continuous brain-body bidirectional flow of multisensory signals. Disruptions of this flow, due to neural damage or sensorimotor deficits limiting environmental interactions, can alter BP. Alterations of BP can occur in diverse conditions including stroke, spinal cord injuries and chronic pain. Unlike motor functions, BP alterations are often overlooked in patients. This oversight limits our understanding of BP alterations, their underlying brain-body mechanism, and rehabilitative strategies. Our team has long been engaged in the study of different aspects of body representation and their alterations. Through the integration of clinical, experimental, neurophysiological and neuroimaging data, we will seek to identify the underlying mechanisms common to several clinical conditions

Research team and environment
This research project will be carried out in the IRCSS Sacro Cuore Don Calabria, Negrar, Verona, Italy. The Rehabilitation Service of the IRCSS headed by Dr. Elena Rossato, has been one of the NPSY.Lab-VR (Department of Human Science, University of Verona) for about 15 years. The laboratory headed by Prof. Valentina Moro is conceived as a multidisciplinary environment to investigate complex questions in cognitive neuroscience, with the integrated contribution of humanities (philosophy, anthropology, sociology, psychology) and medical disciplines (rehabilitation, neurology, geriatrics). The main research focus of the laboratory is on the study of the neurobiological basis of body representation, self-awareness and social cognition. These topics are studied throughout a neuropsychological and experimental approach, in patients suffering from neurological disease, in particular stroke, spinal cord injury and dementia, and chronic pain. Furthermore, the laboratory is particularly engaged in understanding the neuroanatomic correlates of disorders in body representation, self-awareness and social cognition and in the development of new more effective rehabilitation and neuropsychological treatments. Over the years, this research team contributed to the development of innovative tools for the body representation and social abilities assessment. The team consists of several researchers, post-doctoral fellows and PhD students with different backgrounds including psychology, rehabilitation, philosophy, computer sciences and physics. Researchers have access to the NPSY.lab-Vr facility equipped buildings at the University of Verona- IRCSS and in the other three locations in the territory (AFMA, Verona and CEMS-

Memory Center, Verona, Ospedale Maggiore Borgo Trento Verona), where robotic and virtual reality equipment are available as well as the access to neuroimaging and psychophisiological measures recording.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in cognitive neuroscience and neuropsychology, including brain activity recording, imaging, electrophysiology, behavioural testing, virtual reality environment, and data analysis. Multidisciplinary, integrated approaches will be also experienced. Candidates with training backgrounds in life sciences, neuropsychology and rehabilitation, are preferentially considered for this position.

Curriculum 2: Neuroscience and Humanities

Code 2.3

Scholarship funded in the framework of Horizon 2020 Framework Programme ERC AdG 2017
Project number: 789058 — CUP B86C18002710006

Project title: Changing attitudes and actions towards Mafia-type criminal organizations through immersive virtual reality: Behavioural, psychophysiological and neuroscientific studies

ERC Field: SH4 - The Human Mind and Its Complexity; SH4_4 - Neurocognitive psychology; SH4_2 Personality and social cognition; emotion
Key words: Immersive Virtual Reality - Proteus Effect- Embodiment- Psychophysiology – Implicit and explicit cognitive and affective processes- Fighting organized crime
Host Institution: Sapienza University of Rome - Department of Psychology

Reference person/supervisor: Salvatore M Aglioti; salvatoremaria.aglioti@uniroma1.it

Research topic description : Criminal organisations (COs) are widespread worldwide, threatening democracy and socio-economic prosperity. The term “Mafia” refers to COs that originated in the southern regions of Italy but extended their influence planetarily. The success of Mafias can be attributed to their intimidating and corrupting power as well as to their ability to dissuade the local populations to cooperate with law enforcement and foster indifference towards criminal activities in their midst. To understand the psychological and neurobiological mechanisms that underpin individual and social perception of Mafias, we propose a cutting-edge approach that combines immersive virtual reality (IVR) with psychophysiological and neuroscientific methods. This approach allows us to uncover subtle markers of bodily and brain reactivity, as well as implicit attitudes toward COs. Our project capitalizes on the "Proteus effect" a phenomenon wherein individuals embodying virtual avatars tend to adopt the attributes associated with those avatars (e.g. intelligence, omnipotence, honesty), influencing their subsequent actions. We will create immersive IVR scenarios to explore whether taking on the roles of both Mafia and anti-Mafia figures can lead to opposite shifts in implicit and explicit attitudes. We will also investigate changes in behavior, as well as physiological responses, like heart rate variations indicating emotional impact, and neural activity, such as EEG signs of conflict monitoring, related to COs. In addition to ecological and yet highly controlled laboratory investigations employing novel paradigms, our approach includes field research expeditions. These expeditions will provide invaluable data from diverse social strata and geographic regions with high Mafia influence, mitigating the limitations of traditional psychology studies that tend to focus on specific participant groups, such as university students. A groundbreaking aspect of this project lies in the exploration of whether embodying anti-Mafia personas can inspire virtuous, enduring actions against COs. Our ultimate goal is to offer insights that inform the development of neuroscience-based rule-of-law education programs, influence policy decisions, and inspire the actions of law enforcement agencies.

Research team and environment: This research project will be carried out at CoSAN lab (agliotilab.org), Department of Psychology, Sapienza University of Rome, Italy and at the Neuroscience and Society research line at Italian Institute of Technology (https://nes.iit.it/). The laboratories headed by Salvatore M Aglioti is

conceived as a multidisciplinary environment focusing on the investigation of social neuroscience and humanities topics as well as to the development of technological tools for exploring research topics that ranges from empathy for pain to embodied morality by using immersive virtual reality and non-invasive brain and body stimulation and recording techniques. The team consists of five professors, 12 post-doctoral fellows and 8 PhD students with different backgrounds ranging from psychology and philosophy to biomedical engineering. Researchers have access to three full equipped laboratories and access to clinical facilities at the Fondazione Santa Lucia. A list of topics and techniques is reported below

Key topics: Embodiment, Corporeal Awareness, Interoception, Embodied Morality, Body Image Disorders, Empathy, Performance Monitoring, Pleasure, Pain, Autism, Existential Neuroscience, Social Actions & Interactions, Social Decision Making, Neuroleadership, Gut-Brain axis

Key techniques: NIBS (TMS, tDCS, tACS, FUS), EEG, LEPs, fMRI, Physiological measures (EKG, EGG, EMG, Thermal lmaging), lmmersive Virtual Reality, Motion kinematics, Eye tracking, Brain lesion analysis, Computational Modeling, Ingestibels **Preferred Research Skills and Competences :** While there are no specific limitations in terms of the degree needed for applying for the position may attract potential PhD students coming primarily from psychology and neuroscience. Crucially applicants from diverse domains belonging into the humanities (e.g., aesthetics, art history) are encouraged to apply. Degrees in STEM or in other quant areas are very welcome. While experience in experimental psychology, cognitive, social and affective neuroscience may be expected, a strong background in computer graphics and data analysis is considered a plus.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.1

Project title: To study the neurobiological, behavioral and pharmacological basis of drug addiction and related psychopathologies.

ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy;LS5_12 Psychiatric disorders

Key words: Reward and Motivation, Environment, Neurocircuitry, Pharmacology, Electrophysiology,

Host Institution: University of Camerino

Reference person/supervisor: Roberto Ciccocioppo **roberto.ciccocioppo@unicam.it**

Research topic description

Substance Use Disorder (SUD) is a psychiatric condition associated with increased health risks and social harm with dramatic impact to the global disease burden. In humans addictive behavior is characterized by a shift from recreational to compulsive drug seeking as described in the DSM-IV. Long-term consumption of substances of abuse induces neuroadaptations that are associated with loss of control, compulsive drug taking and negative emotional states (i.e. anxiety, depression). However, not all subjects develop SUD in response to prolonged exposure to drugs. Inter-individual vulnerability to lose control of drug consumption and develop addiction depends upon genetics, environment, personality traits, psychiatric comorbidities and the interplay of all these factors. Our laboratory is aimed at investigating the mechanisms through which these factors (and their interaction), contribute to SUD vulnerability with the ultimate objective of identifying novel molecular targets and therapies to treat SUD. To exploit these projects, in addition to classical pharmacological manipulations, in vivo optogenetic, chemogenetic and neurophysiological approaches will be used. Viral mediated upregulation and downreulation of specific receptors in selected brain areas are used to determine the role of specific neurocircuitry in encoding vulnerability to SUD. *Ex vivo* brain slice electrophysiology will be also used to support the study.

Research team and environment

This research project will be carried out in the School of Pharmacy, Center for Neuroscience, University of Camerino, Italy. The laboratory headed by Prof. Roberto Ciccocioppo is conceived as a multidisciplinary environment to investigate complex questions in neuroscience. The main research focus of the laboratory is

on the study of the neurobiological basis of abnormal behavior and brain functions relevant to human psychopathology with emphasis on motivation and reward-related disorders. The majority of this work is directed at the understanding the neurological mechanisms responsible for these aberrant behaviours and at identifying innovative pharmacological targets to aid the development of new more effective treatments. Attention to the study of neurocircuitry and molecular mechanisms controlling emotional and cognitive disturbances associated with protracted exposure to drugs of abuse or chronic stress is also an important area of research. Over the years this research team contributed to the preclinical development of at least 3 compounds that reached various clinical development stages. The team consists of several researchers, post-doctoral fellows and PhD students with different backgrounds including biology, pharmacology, philosophy, psychology and physics. Researchers have access to 1500 m^2 of animal facility equipped with operant self-administration chambers, EPM equipments, Porsolt swimming tubes, open field arenas for social interaction, Noldus Etovision system for behavioral monitoring, etc. Fully equipped lab for immunohistochemistry, light, confocal and scanning electron microscopes are available. One laboratory is equipped an Electrophysiological setup for patch-clamp recordings in slices. Finally, equipment for molecular and cellular studies is available.

3.2 Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including brain activity recording, imaging, electrophysiology, proteomics, behavioural testing, molecular biology, histology and data analysis. Pharmacological, chemogenetic and optogenetic approaches will be also experienced. Candidates with training backgrounds in life sciences, behavioral pharmacology, electrophysiology, pharmaceutical sciences, molecular genetics, are preferentially considered for this position.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.2

Project title: Exploiting astrocytic GDNF in a gene therapy approach for Parkinson's disease and drug-resistant epilepsy.

ERC Field: LS5_11 Neurological and neurodegenerative disorders; LS7_05 Applied gene, cell and immune therapies; LS5_02 Glial cells and neuronal-glial communication

Key words: Epilepsy; Parkinson disease; Adeno-associated vectors; Lenti-vectors; neurotrophic factors

Host Institution: University of Ferrara

Reference person/supervisor: Michele Simonato **michele.simonato@unife.it**

Research topic description
Glial cell line–derived neurotrophic factor (GDNF) is a pleiotropic neurotrophic factor, widely expressed and secreted within the central nervous system (CNS). Under pathological conditions, GDNF expression and release by glial cells can be upregulated, exerting neuroprotective effects while also potentially modulating glial activation and neuroinflammation. The neuroprotective properties of GDNF have garnered significant interest for potential applications in neurodegenerative disorders. In this research project, we aim to develop a novel gene therapy-based approach to drive a localized and sustained release of GDNF in striatal astrocytes to reduce neurodegeneration in a mouse model of Parkinson's Disease (PD) and in hippocampal astrocytes to prevent seizure in a rat model of temporal lobe epilepsy (TLE).

Research team and environment
This research project will be carried out in the Department of Neuroscience and Rehabilitation, University of Ferrara, Italy. The team led by Prof. Simonato includes a group of researchers expert in different, complementary fields of neuroscience, from physiology to pharmacology, from molecular biology to clinical neuroscience. The group have access to a large laboratory space, including 5 rooms for histology and immunohistochemistry, chemistry, cell biology, molecular biology, electrophysiology. In addition, it has access to university facilities, including state-of-the-art animal facility, animal behavior assessment, live imaging, electron microscopy. In addition, a scientific agreement is established with the University Vita-Salute San

Raffaele of Milan, Italy, where Prof. Simonato co-leads a research group with long-standing expertise in gene therapy. This group also have access to the facilities of San Raffaele, including transcriptomics, imaging and bioinformatics.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including brain activity recording, imaging, electrophysiology, proteomics, behavioral testing, molecular biology, histology and data analysis. In vivo gene therapy approaches will be also experienced. The optimal candidate should have a background in biology and/or medicine, with experience in laboratory work, possibly both in vitro and in vivo.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.3

Project title: Personalized treatments of early-onset developmental encephalopathies caused by pathogenic variants in neuronal KCNQ genes

ERC Field: LS1_13 Early translational research and drug design; LS1_14 Innovative methods and modelling in molecular, structural and synthetic biology; LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy

Key words: Structural biology, Potassium channels, KCNQ, Pharmacology, Electrophysiology,

Host Institution: University of Naples Federico II

Reference person/supervisor: MaurizioTaglialatela, MD PhD; mtaglial@unina.it

Research topic description
Developmental and epileptic encephalopathies (DEEs) represent a heterogeneous group of rare but severe neurodevelopmental disorders characterized by early-onset, drug-resistant seizures accompanied by significant neurodevelopmental impairment with autism spectrum disorder and intellectual disability. Current therapeutic options are inadequate: most patients with DEE do not achieve seizure control with conventional anticonvulsants, and no therapies targeting neurodevelopmental impairments are currently available. Genetic DEEs represent up to 25% of all DEEs and are caused by inherited or de novo pathogenic variants in genes critical for neuronal activity. Mutations in genes encoding for ion channels are the most frequent cause of DEE. Therefore, drug design and translational research studies focused on the principal ion channels associated with DEEs are urgently needed to pose the necessary basis for effective treatments. KCNQ2/3/5 genes encode voltage-gated potassium (K+) channels subunits expressed in neurons, where they underlie the M-current (IKM), a repolarizing current that reduces neuronal excitability and regulates firing frequency. Mutations in the KCNQ2/3/5 genes are associated with a broad spectrum of human neuronal channelopathies with distinct clinical phenotypes; in particular, KCNQ2-DEE is one of the earliest-onset DEE.
Our team has identified new KCNQ activators which may act as potent anticonvulsant and analgesic drugs. In this project, we aim to define the structural features required for KCNQ activation and inhibition, using a combination of biochemical, electrophysiological, pharmacological and structural techniques. In particular, the PhD student will establish the biochemical framework required for KCNQ2 structural determination; KCNQ2 will be, first, expressed and produced and new drugs binding confirmed using FSEC-Thermal Shift assay. Purified KCNQ2 bound to the new drugs will be then analysed by cryo-EM.

Research team and environment
This research project will be carried out in the Section of Pharmacology of the Dept. o Neuroscience of the Federico II University of Naples. The laboratory headed by Prof. Maurizio Taglialatela is conceived as a multidisciplinary environment to develop new pharmacological approaches for the treatment of severe neurodevelopmental disorders, including autism spectrum disorders and developmental/epileptic encephalopathies. investigate complex questions in neuroscience. The team includes several professors, researchers, post-doctoral fellows and PhD students with different backgrounds including biology, pharmacology, biotechnology and engineering. The team has access to an animal facility equipped with tools

for recording seizures using telemetry and for assessing animal behavior (such as open field arenas for social interaction, Noldus Etovision system for behavioral monitoring, etc). Fully equipped lab for immunohistochemistry, light, and confocal microscopy. Three electrophysiological setups for patch-clamp recordings in slices and cells are also available. Extensive use of neurons derived from induced pluripotent stem cells (IPSCs) is envisaged during the project; several lines are currently available in the lab, including isogenic controls. Equipment for molecular and cellular studies is also available

Preferred Research Skills and Competences

The Candidate must have a solid background in physiology, pathophysiology and pharmacology; pre- or post-master experience of at least 12 months in a research lab is preferred. Familiarity with cellular and/or molecular biology techniques is also highly desired, as is previous experience with advanced structural biology/biochemical techniques. A sincere interest in setting the basis for a career in neuroscience research is a must, with good English reading and comprehension abilities, attitude to teamwork, and willingness to learn novel techniques in stimulating environments. Both national and international collaborations will allow the candidate to spend periods in other labs.

Selected Recent publications

1. Kv7.2 loss-of-function causes early hyperexcitability and network remodelling. Dirkx N, Kaji M, De Vriendt E, Carleo G, Miceli F, Asselbergh B, Verstraelen P, Zonnekein N, Carotenuto L, Dang LT, Sommers V, Vlaemynck E, Lagae L, Ceulemans B, De Jonghe P, De Vos WH, Taglialatela M, Weckhuysen S. Brain. 2026 Jun 6:awag199. doi: 10.1093/brain/awag199. Online ahead of print. PMID: 42249507 Free article.

2. Two-step voltage-sensor activation of the human KV7.4 channel and effect of a deafness-associated mutation. Nappi M, Frampton DJA, Kusay AS, Wang K, Yasarbas SS, Pozzi S, Miceli F, Liin SI, Taglialatela M, Pantazis A. Nat Commun. 2026 Feb 5;17(1):2381. doi: 10.1038/s41467-026-69249-8. PMID: 41639121 Free PMC article.

3. The fast-dissociating D2 antagonist antipsychotic JNJ-37822681 is a neuronal Kv7 channel opener: Potential repurposing for epilepsy treatment. Carotenuto L, Keminer O, Carleo G, Zaliani A, Leo A, Citraro R, De Sarro G, Dirkx N, Kaji M, Weckhuysen S, Reinshagen J, Barrese V, Guida N, Ostacolo C, Miceli F, Gribbon P, Taglialatela M. Br J Pharmacol. 2025 Nov;182(22):5574-5595. doi: 10.1111/bph.70119. Epub 2025 Jul 23. PMID: 40702669

4. The epilepsy-autism phenotype associated with developmental and epileptic encephalopathies: New mechanism-based therapeutic options. Specchio N, Di Micco V, Aronica E, Auvin S, Balestrini S, Brunklaus A, Gardella E, Scheper M, Taglialatela M, Trivisano M, Curatolo P. Epilepsia. 2025 Apr;66(4):970-987. doi: 10.1111/epi.18209. Epub 2025 Feb 22. PMID: 39985505 Review.

5. Targeting Kv7 Potassium Channels for Epilepsy. Perucca E, Taglialatela M. CNS Drugs. 2025 Mar;39(3):263-288. doi: 10.1007/s40263-024-01155-3. Epub 2025 Jan 24. PMID: 39853501 Free PMC article. Review.

6. Constitutive opening of the Kv7.2 pore activation gate causes KCNQ2-developmental encephalopathy. Nappi M, Alberini G, Berselli A, Roscioni A, Soldovieri MV, Servettini I, Barrese V, Weckhuysen S, Chiu TA, Scheffer IE, Benfenati F, Maragliano L, Miceli F, Taglialatela M. Proc Natl Acad Sci U S A. 2024 Dec 3;121(49):e2412388121. doi: 10.1073/pnas.2412388121. Epub 2024 Nov 27. PMID: 39602259 Free PMC article.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.4

Project title: **N**eurobiology and Neuropharmacology of Impulsivity, Attention Deficit Hyperactivity Disorder, and Substance Use Disorders.

ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy; LS5_12 Psychiatric disorders

Key words: Impulsivity, Attention, Reward and Motivation, Environment, Neurocircuitry, Psychopharmacology,

Host Institution: University of Camerino

Reference person/supervisor: Nazzareno Cannella, **nazzareno.cannella@unicam.it**

Research topic description

Maladaptive impulsivity is a multifaceted behavior characterized by premature, risky, and inappropriate actions. Together with deficits in sustained attention, it is a diagnostic hallmark of attention-deficit/hyperactivity disorder (ADHD). Maladaptive impulsivity is also associated with an increased risk of developing substance use disorders (SUDs).

We aim to investigate the neurobiological underpinnings of impulsive behavior and attention, and their roles in ADHD and SUDs. Specifically, our goal is to characterize the contribution of stress-related neural systems to these conditions. To achieve this, we combine behavioral models of ADHD and SUD with pharmacological and genetic manipulations, as well as in vivo optogenetic, chemogenetic, and neurophysiological approaches. We also use viral-mediated upregulation and downregulation of specific receptors in targeted brain regions to investigate the role of distinct neural circuits. Histological and biomolecular techniques further support these investigations.

Successful completion of this project will support the development of future treatments for ADHD and SUDs, two major societal burdens for which currently approved therapies have limited efficacy.

Research team and environment

This research project will be carried out at the School of Pharmacy, Center for Neuroscience, University of Camerino, Italy. The laboratory, led by Prof. Nazzareno Cannella, is an international research group within the University's Center for Neuroscience (CNS). The CNS fosters a multidisciplinary, diverse, and collaborative environment in which complex questions in neuroscience are addressed through the integration of multiple scholarly perspectives, thereby providing students with high-quality scientific training.

The laboratory's main research focus is the investigation of the neurobiological mechanisms and brain functions underlying motivated behaviors and the psychopathology of ADHD and SUD, with particular emphasis on reward seeking, motivation, impulsivity, an attention. The lab's ultimate goal is to improve understanding of the neurobiological basis of these maladaptive behaviors and by them to understand biological bases of human's motivated behavior. Ultimately, the lab aims to facilitate the development of innovative treatments. In the field of psychopharmacology, the lab also investigates precision medicine, particularly through the study of endophenotypes associated with diagnostic heterogeneity and treatment response.

The laboratory has access to a 1,500 m² BSL2 animal facility equipped with operant self-administration chambers, an Elevated Plus Maze, a Porsolt swim test apparatus, Open Field arenas, and behavioral monitoring systems such as Noldus EthoVision and AnyMaze. The lab is fully equipped for immunohistochemistry and RNAscope and has full access to light, fluorescence, confocal, and scanning electron microscopes. In addition, equipment for molecular and cellular analyses is readily available.

Preferred Research Skills and Competences

The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience and pharmacology, including brain imaging, proteomics, behavioral testing, molecular biology, histology, and data analysis. The candidate will also gain experience with pharmacological, chemogenetic, optogenetic, and genetic engineering approaches. Applicants with academic backgrounds in life sciences, behavioral pharmacology, pharmaceutical sciences, molecular biology, genetics, or medicine will be given preference for this position.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.5

Scholarships funded by foreign countries and reserved to CSC (Chinese Scholarship Council) beneficiaries

**subject to confirmation (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Cortical circuits in neurodevelopmental and psychiatric disorders.

ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy;LS5_12 Psychiatric disorders

Key words: Social Behavior, Neurocircuitry, Emotions, Optogenetics, in vivo imaging,

In cooperation with: Istituto Italiano di Tecnologia

Reference person/supervisor: Francesco Papaleo **francesco.papaleo@iit.it**

Research topic description
Social behavior refers to several processes associated with interactions of the individual with others. Dysfunctions in these abilities are hallmark of neurodevelopmental disorders such as schizophrenia and autism. But are all social interactions qualitatively the same? Does 'social interaction' have the same meaning for different subjects? What are the brain mechanisms underlying social interactions, social choices and the perception/reaction to different emotions in others? Are there multibrain cell- and circuit-specific mechanisms that are critically involved in clinically relevant alterations of emotion recognition?
The research project aims to evaluate cortical circuits subtending the developmental trajectories of higher order social cognitive functions, in normal condition and genetic conditions characterized by aberrant social behaviors. A special focus will be on elucidating the cellular-level mechanisms underlying multibrain dynamics in different social contexts. To achieve this goal, using a variety of genetically modified mice, you will employ a combined approach strictly linking advanced behavioral outputs (complex socio-cognitive tasks including emotion recognition, cooperation, altruism, hierarchy, social reward etc.) with circuit-level manipulations with in vivo chemo- and opto-genetics, in vivo miniscopes, in vivo fiberphotometry, and in vivo electrophysiology.
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Research team and environment
You'd be working in a multicultural and multi-disciplinary group, where biologists, pharmacologists, psychologists, medical doctors, mathematicians and bioengineers' experts collaborate, each with their own expertise, to carry out common research.
The Genetics of Cognition Research line is coordinated by Dr. Francesco Papaleo, who has extensive experience in the Neuroscience area (https://geco.iit.it/).
The research focuses on multidisciplinary research projects to investigate the neuromodulation and circuits involved in the expression and development of high-level socio-cognitive abilities in *in vivo* genetically modified models relevant to neurodevelopmental disorders. To achieve this goal, we employ a combined approach strictly linking advanced behavioral outputs (social tasks including emotion recognition, cooperation, altruism, hierarchy, social reward etc.) with cell- specific circuit-level manipulations using *in vivo* chemo- and opto-genetics, *in vivo* miniscopes, *in vivo* fiberphotometry, and *in vivo* electrophysiology. For reference to recent work, please see: Maltese et al., *Nature Neuroscience* 2025; Dautan et al., *Nature Neuroscience* 2024; Scheggia et al., *Nature Neuroscience* 2022; Mastrogiacomo et al., *Molecular Psychiatry* 2022; Scheggia et al., *Nature Neuroscience* 2020; Ferretti et al., *Current Biology* 2019; Scheggia et al., *Nature Communications* 2018.

Preferred Research Skills and Competences
A master degree in biology, neuroscience, pharmacology, medicine, bio-engineering, computational sciences, mathematics or a related discipline. Preferred experience with in vivo preclinical studies. Excellent communication and writing skills in English. Extra plus if experience in coding.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.6

the giovanni ARMENISE HARVARD foundation

Scholarship in the framework of an initiative funded by the Giovanni Armenise Harvard Foundation - CUP: J14G20000440005

Title: Defining the role of neuromodulatory systems in sleep loss–induced susceptibility to addiction

ERC Field: LS5_2 Molecular and cellular neuroscience; LS5_3 Neurochemistry and neuropharmacology, LS5_8 Behavioral neuroscience; LS5_12 Psychiatric disorders

Key words: Reward and motivation, sleep, synapses, neurocircuitry, electrophysiology, electron microscopy, calcium imaging, optogenetics

Host Institution: University of Camerino

Reference person/supervisor: Luisa de Vivo **luisa.devivo@unicam.it**

Research topic description

Sleep disturbances and alcohol use disorder (AUD) exhibit a strong and bidirectional association that contributes to the onset, maintenance, and recurrence of both conditions. While alcohol is commonly used to relieve insomnia and other sleep-related complaints because of its initial sedative effects, prolonged or excessive consumption profoundly disrupts sleep architecture, leading to poorer sleep quality and reduced sleep continuity. In turn, insomnia and other sleep disturbances are highly prevalent in individuals with AUD and frequently persist even after cessation of alcohol use. Growing evidence indicates that sleep dysfunction is not merely a consequence of alcohol misuse but also a key contributor to craving, increased alcohol intake, and relapse vulnerability during abstinence. Understanding the mechanisms underlying this reciprocal relationship is therefore critical for improving treatment outcomes and preventing relapse in individuals with AUD. This project aims to define how chronic sleep loss and exposure to alcohol during adolescence affect the maturation and refinement of neuromodulatory circuits that regulate vigilance states and addictive behaviors. Over a three-year period, the researcher will: (1) map the effects of sleep loss and alcohol exposure on noradrenergic, dopaminergic, and orexinergic neurons using histochemical and molecular approaches; and (2) determine the contribution of these neuromodulatory systems in mediating the link between sleep loss and the development of substance use disorders through pharmacological, chemogenetic and optogenetic manipulations. This research will provide critical insight into the cellular consequences of chronic sleep deprivation and identify biological mechanisms that may drive increased vulnerability to substance use in sleep-deprived individuals.

Research team and environment

The candidate will have the opportunity to learn cutting-edge techniques and to develop their own scientific ideas and ambitions within the context of the research topic. This research project will be carried out in the School of Pharmacy, Center for Neuroscience, University of Camerino, Italy. The laboratory led by Luisa de Vivo and Michele Bellesi aims at understanding the functions and mechanisms of sleep in health and disease. Our research combines morphological and functional methods of analysis in both animals and humans to investigate why sleep is beneficial for the brain at the molecular, circuit and behavioral level. On one hand, we are focused on mapping the consequences of sleep impairment across the lifecycle and characterizing the interaction between sleep disruption and other environmental and genetic factors. On the other hand, we are interested in the therapeutic potential of sleep enhancement to improve health and cognition at different levels. To this aim, we are studying pharmacological and non-pharmacological approaches to mitigate neuropsychiatric and neurodegenerative conditions by targeting sleep.
The lab explores also scientific questions linking sleep to glial cells, gut microbiome, cellular metabolism, adipose tissue, torpor, etc., thanks to the collaboration with other research groups within the University of Camerino and outside. Relevant publications, key interests of the research group, and the Laboratory manual can be found at https://www.bsr-laboratory.org/. The team consists of several international post-doctoral fellows and PhD students with different backgrounds including biology, pharmacology, psychology, informatics, and physics. Researchers have access to 1500 m2 of animal facility equipped with systems for EEG/EMG and LFP recordings, in vivo calcium imaging in freely behaving rodents, automatic motion detection, apparata for behavioral tests, and a new human sleep laboratory. Fully equipped labs for immunohistochemistry, light, confocal, and electron microscopy, cell culture, and molecular biology are available.

Preferred Research Skills and Competences
The doctoral candidate will receive training in animal handling, histology, in vivo and ex vivo imaging, electrophysiology in vivo, behavioural testing, molecular biology, and data analysis. Pharmacological, chemogenetic and optogenetic approaches will be also experienced. The ideal candidate has a genuine passion for neuroscience and sleep research, a proactive attitude in studying relevant literature, formulate plausible hypothesis and experiments to test them. Self-motivation, curiosity, and ability to work both alone and in team are essential characteristics. Background in experimental research with rodents, basic knowledge of R, Python or Matlab, and a propensity to care for details are desirable.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.7

Project title: Psilocin-mediated modulation of microglial neuroinflammation in multiple sclerosis: an in vitro study on glia-oligodendrocyte crosstalk

ERC Field: LS 3 Cellular and Developmental Biology; LS 4 Physiology, Pathophysiology and Endocrinology; LS 5 Neuroscience and Neural Disorders and LS 6 Immune and Infection

Key words: Neurodegeneration, neuroimmunology, serotoninergic signaling, Ary hydrocarbon receptor (AhR), inflammasome (NLRP3), neuroprotection.

Host Institution: University of Cagliari

Reference person/supervisor: Paola Fadda/Eleonora Cocco
paola.fadda@unica.it
eleonora.coccounica.it

Research topic description

Multiple sclerosis (MS) is a chronic immune-mediated disease of the central nervous system characterized by persistent neuroinflammation, demyelination, oligodendrocyte dysfunction, and progressive neuroaxonal degeneration. Although current disease-modifying therapies effectively reduce acute inflammatory activity, they have limited efficacy in preventing chronic microglial activation and the failure of remyelination, particularly in progressive forms of the disease. Consequently, identifying novel strategies capable of modulating microglial inflammatory responses has emerged as a promising avenue for the development of innovative therapeutic approaches.

Recent evidence suggests that psilocin, the active metabolite of psilocybin, exerts immunomodulatory effects beyond its well-established serotonergic actions, influencing microglial activation and neuroplasticity through serotonin receptor-dependent and aryl hydrocarbon receptor (AhR)-related signaling pathways. However, whether these mechanisms can modulate neuroinflammatory processes relevant to MS remains largely unexplored.

The present PhD project aims to investigate the ability of psilocin to regulate inflammatory activation of human microglia and to determine whether these effects reduce secondary damage to oligodendrocyte-like cells. Using an in vitro human model based on HMC3 microglial cells and oligodendrocyte-like cell lines, the project will characterize the impact of psilocin on inflammatory cytokine production, inflammasome activation, oxidative stress, and neurotrophic signaling. Particular attention will be devoted to the modulation of NF-κB, NLRP3, CREB/BDNF, serotonergic receptors, and AhR-associated pathways, as well as to the functional consequences of altered microglial secretome on oligodendrocyte viability and myelin-related markers.

Rather than attempting to reproduce the complexity of MS, this project focuses on specific pathological events that critically contribute to disease progression, namely microglial neuroinflammation and microglia-oligodendrocyte crosstalk. This mechanistic approach provides a biologically relevant and experimentally feasible platform for identifying cellular pathways that may represent future therapeutic targets.

Overall, the study will provide novel insights into the role of serotonergic modulation of microglia in MS-relevant neuroinflammation and may establish a scientific basis for the future exploration of psychedelic-derived compounds as immunomodulatory agents in neurodegenerative diseases.

Research team and environment

This PhD project will be carried out at the Department of Biomedical Sciences, University of Cagliari (Italy) under the joint supervision of Prof. Paola Fadda and Prof. Eleonora Cocco. **Prof. Paola Fadda** leads a multidisciplinary Neuropharmacology Research Group with extensive expertise in neuropharmacology, neuroinflammation, glial biology and the identification of innovative therapeutic targets for neurological and neuropsychiatric disorders. The research team includes senior researchers, postdoctoral fellows, PhD candidates and medical residents with complementary expertise in pharmacology, neuroscience, molecular biology and cellular biology. The laboratory is fully equipped for mammalian cell culture and advanced molecular and cellular techniques, including qRT-PCR, Western blotting, ELISA, immunofluorescence, fluorescence microscopy and image analysis, providing all the facilities required to investigate the mechanisms proposed in this project. The project will also benefit from the collaboration with the Multiple Sclerosis Centre at Binaghi Hospital**,** led by **Prof. Eleonora Cocco** (also co-supervisor)**,** Full Professor of Neurology and an internationally recognised expert in human MS. Her extensive clinical and research experience in MS pathophysiology, biomarkers and disease-modifying therapies will ensure a strong translational perspective, linking the experimental findings with clinically relevant aspects of multiple sclerosis.

In addition, the research team has access to the **Centre for Advanced Studies, Research and Development in Sardinia (CeSAR)**, a state-of-the-art multidisciplinary research infrastructure providing advanced technologies and scientific support in imaging, genomics, proteomics, bioinformatics and other cutting-edge methodologies. The project will further benefit from the international collaborations established through the **PNRR-TNE NEUROBRIDGE** network, offering an excellent multidisciplinary and international research environment for doctoral training. Overall, the combination of an experienced multidisciplinary research team, excellent laboratory facilities and access to advanced technological platforms provides an outstanding environment for successfully carrying out the proposed research.

Preferred Research Skills and Competences

The doctoral candidate will receive comprehensive training in the experimental techniques most commonly used in neuroscience research, including mammalian cell culture, molecular biology, enzyme-linked immunosorbent assay (ELISA), fluorescence microscopy, data acquisition, statistical analysis and scientific data interpretation.
Applicants with a background in Life Sciences, Neuroscience, Pharmacology, Biotechnology, Molecular Biology, Biomedical Sciences or related disciplines are encouraged to apply. Previous experience in cell culture, molecular biology, neuropharmacology, neuroimmunology or behavioral pharmacology will be considered an advantage but is not mandatory.
The successful candidate should demonstrate a strong motivation for experimental research, critical thinking, problem-solving abilities and good organizational skills. The ability to work both independently and collaboratively within a multidisciplinary research team is essential, together with excellent communication skills and a good command of English. Willingness to participate in international collaborations, scientific conferences, training activities and research mobility programmes is highly desirable.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.8

** N. 1 PhD position to be awarded in the framework of the Commitment by the University of Changchun is reserved to candidates graduated from Changchun University of Technology*

Project title: To study the neurobiological, behavioral and pharmacological basis of drug addiction and chronic pain: Focus on the opioid system.

ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy;LS5_12 Psychiatric disorders

Key words: opioid use disorders, pain, opioid agonists, drug abuse, reward and motivation

Host Institution: University of Camerino

Reference person/supervisor: Roberto Ciccocioppo roberto.ciccocioppo@unicam.it

Research topic description
Opioid abuse is a serious global problem that affects the health, social and economic welfare of all societies. Opioid use disorder (OUD) is a medical condition characterized by the compulsive use of opioids despite adverse consequences from continued use and the development of a withdrawal syndrome when opioid use ends. Animal models provide a rigorous, convenient means to precisely control environmental context and drug exposure, and
assess behavioral, molecular and cognitive changes associated with opioid use. Effective utilization of such models can be used to identify more efficacious pharamacotreatments for pain based on opioid agonism while simultaneously limiting their abuse potential. The aim of this PhD project is to study at behavioral, cellular and molecular levels the mechanisms through which is possible to treat pain and addiction by targeting the opioid receptor system.

Research team and environment
This research project will be carried out in the Laboratory of Neuropsychopharmacology, School of Pharmacy, University of Camerino, Italy. The laboratory, headed by Roberto Ciccocioppo, is conceived as a multidisciplinary environment to investigate complex questions in neuroscience. The main research focus of the laboratory is on the study of the neurobiological basis of abnormal behavior and brain functions relevant to human psychopathology with emphasis on motivation and reward-related disorders. The majority of this work is directed at the understanding the neurological mechanisms responsible for these aberrant behaviours and at identifying innovative pharmacological targets to aid the development of new more effective treatments. Attention to the study of neurocircuitry and molecular mechanisms controlling emotional and cognitive disturbances associated with protracted exposure to drugs of abuse or chronic stress is also an important area of research. Over the years this research team contributed to the preclinical development of at least 3 compounds that reached various clinical development stages. The team consists of several researchers, post-doctoral fellows and PhD students with different backgrounds including biology, pharmacology, philosophy, psychology and physics. Researchers have access to 1500 m2 of animal facility equipped with 50 operant self-administration

chambers, EPM equipments, Porsolt swimming tubes, open field arenas for social interaction, Noldus Etovision system for behavioral monitoring, and areas dedicated to surgical procedures etc. Fully equipped lab for immunohistochemistry, light, confocal and scanning electron microscopes are also available. One laboratory is equipped an Electrophysiological setup for patch-clamp recordings in slices. Finally, equipment for molecular and cellular studies is available.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including brain activity recording, imaging, electrophysiology, proteomics, behavioural testing, molecular biology, histology and data analysis. Pharmacological, chemogenetic and optogenetic approaches will be also experienced. Candidates with training backgrounds in life sciences, behavioral pharmacology, neurophysiology, pharmaceutical sciences, are preferentially considered for this position.

Curriculum 3: Preclinical Clinical and Translational Neuroscience

Code 3.9

Project title: To evaluate the neurobiological mechanisms regulating NaCl and water intake in rodent models.
ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy
Key words: Salt intake, thirst, motivation, neuronal damage, mineralocorticoids, hormones
Host Institution: University of Camerino
Reference person/supervisor: Carlo Polidori carlo.polidori@unicam.it

Research topic description. This research aims to explore the physiology and regulation of sodium chloride (NaCl) and water intake, focusing on the neurobiological mechanisms controlling their consumption and their health impacts. The study investigates the role of the hypothalamus and the renin-angiotensin-aldosterone system (RAAS) in regulating NaCl appetite and intake through a combination of animal studies using rodent models of excessive NaCl consumption and polydipsia. Through manipulation of dietary NaCl levels, or through pharmacological stimulation of its intake we aim to modify the neural and hormonal pathways, responsible for the motivation to its consumption. The expected outcomes include a detailed understanding of the neural circuits and hormonal influences on NaCl regulation, as well as the relationship between high NaCl intake and neurological damages possibly associated with hypertension. The findings aim to inform public health strategies and therapeutic approaches to manage salt consumption and mitigate associated health risks.

Research team and environment
This research project will be carried out in the Laboratory of Behvaioral Pharmacology, School of Pharmacy, University of Camerino, Italy. The team has established experience in rodent models of ingestive behavior. Reseacher will have access to 1500 m2 of animal facility equipped with metabolic cages, EPM equipments, Porsolt swimming tubes, open field arenas for social interaction, Noldus Etovision system for behavioral monitoring, Equipments for immunohistochemistry, western blot and gine expression analysis are also available.

Preferred Research Skills and Competences
The doctoral candidate will receive training in behavioral pharmacology technique commonly used in basic neuroscience. Candidates with training backgrounds in life sciences, behavioral pharmacologyphysiology, pharmaceutical sciences, are preferentially considered for this position.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.10

Project title: To study the role of the ghrelin system to develop new neutraceutical to treat depression and reward related disorders

ERC Field: LS5 Neuroscience and Disorders of the Nervous System; LS7 Prevention, Diagnosis and Treatment of Human Diseases
Key words: Neuropharmacology, motivation, sucrose, neuropeptides
Host Institution: University of Camerino
Reference person/supervisor: Esi Domi esi.domi@unicam.it

This research project aims to explore the therapeutic potential of targeting the ghrelin (GR) system for the development of natural product-based treatments for depression and reward-related disorders. By investigating how peripheral and central modulation of ghrelin influences the activity of dopaminergic neurons projecting to the nucleus accumbens, and by comparing the role of endogenous ghrelin in reinforcing natural (e.g., sucrose) versus pharmacological (e.g., alcohol) rewards, the project seeks to uncover key mechanisms underlying motivation and reward sensitivity. Pharmacological interventions, including selective natural GR receptor antagonists and inhibitors of ghrelin activation, will be evaluated alongside advanced techniques such as in situ hybridization and immunohistochemistry, to define the neurochemical and functional impact of GR modulation. The industrial implications are significant, as this research may lead to the identification and development of novel, naturally derived compounds that safely and effectively modulate the reward system—providing a new class of treatments for depression, substance use disorders, and other conditions linked to dysfunctional motivation and hedonic processing.

Research team and environment

This research project will be carried out in the School of Pharmacy, Center for Neuroscience, University of Camerino, Italy and Biotecnica. The laboratory headed by dr Ei Domi is conceived as a multidisciplinary environment to investigate complex questions in the field of neuroscience, advancing the understanding of the molecular basis of neuropsychiatric and neurodegenerative disorders. Biotecnica has well established exeprise in the development of natura products to support human health.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.11

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Identification of the artery-brain circuit involved in aortic aneurism progression

ERC Field: LS4_1 - Organ and tissue physiology and pathophysiology; LS4_10 - The cardiovascular system and cardiovascular diseases

Key words: Brain signaling, cardiovascular disease, mouse models

Host Institution: "Sapienza" University of Rome - Department of Medico-Surgical Sciences and Biotechnologies

Reference person/supervisor:
Prof. Daniela Carnevale daniela.carnevale@uniroma1.it
SSD MED/50 Advanced Medical and Surgical Technology and Methodology

RTT Sara Perrotta sara.perrotta@uniroma1.it

SSD MED/50 Advanced Medical and Surgical Technology and Methodology

Project description:

Aortic aneurysms are focal dilatations of the artery wall. Nervous and immune systems are important contributors in maintaining contractile vascular function. We hypothesize that mechanical and inflammatory disturbances in the vessel wall send signals to the brain, initiating a feedback loop that modulates aortic inflammation and drives aortic aneurysm progression. Our hypothesis is that at the beginning of aortic aneurysm formation, the main afferent signal to the brain is departing from the vessel wall itself. Our aim is to delineate the neuronal circuits between the artery and the brain to identify which brain areas are activated by dysfunctional aortic wall. The candidate role will be to establish the $Fos^{TRAP2;TdTomato}$ mice, a transgenic mouse model allowing us to visualize activated brain areas by tagging the activity of neurons recruited during aortic aneurism challenge, collect data of brain analysis by immunohistochemistry and spatial proteomics approaches.

Research team and environment: This research will be conducted at Sapienza University, Department of Medico-Surgical Sciences and Biotechnologies in the lab of Prof. Daniela Carnevale, in the Molise unit situated on the joint research platform shared with IRCCS Neuromed. The laboratory headed by Prof. Carnevale is an integrated lab spanning through basic and translational science, with the overall aim of disentangling the relationship between vasculature and brain concerning both the neural mechanisms driving the cardiovascular system and the neural consequences of the cardiovascular system dysregulation.

Preferred Research Skills and Competences

The ideal candidate has previous experience in experimental models of cardiovascular diseases, mouse handling, surgery and in ex-vivo brain analysis.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.12

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Investigating the neural circuit shaping vascular immune cells niche contributing to aortic aneurysm

ERC Field: LS4_1 - Organ and tissue physiology and pathophysiology; LS4_10 - The cardiovascular system and cardiovascular diseases

Key words: Neuroimmune interaction, cardiovascular disease, peripheral nervous system

Host Institution: "Sapienza" University of Rome Department of Medico-Surgical Sciences and Biotechnologies

Reference person/supervisor:
Prof. Daniela Carnevale daniela.carnevale@uniroma1.it
SSD MED/50 Advanced Medical and Surgical Technology and Methodology

RTT Sara Perrotta sara.perrotta@uniroma1.it
SSD MED/50 Advanced Medical and Surgical Technology and Methodology

Project description:

Aortic aneurysms are focal dilatations of the artery wall. Nervous and immune systems are important contributors in maintaining contractile vascular function. Recruited and self-renewing arterial macrophages are crucial players in modulating vascular contractility and defective TGFβ signaling is associated with vascular inflammation and spontaneous aortic aneurism formation. Our aim is to understand how nervous and immune systems interact during aortic aneurism progression, in order to modulate immune response and counteract aortic aneurysm development. We will investigate functional cell-cell neuroimmune interactions established between neurons, immune cells and vasculature in aorta developing aneurysm. We will evaluate the contribution of the efferent reflex circuit in regulating immune response and infiltration in aneurismatic aorta. The candidate role will be to investigate functional cell-cell interactions established between neurons, immune cells and the vasculature in aorta developing aneurysm, and evaluate the contribution of the efferent reflex circuit in regulating the immune response involved in aortic aneurysm onset and progression.

Research team and environment: This research will be conducted at Sapienza University, Department of Medico-Surgical Sciences and Biotechnologies in the lab of Prof. Daniela Carnevale, in the Molise unit situated on the joint research platform shared with IRCCS Neuromed. The laboratory headed by Prof. Carnevale is an integrated lab spanning through basic and translational science, with the overall aim of disentangling the relationship between vasculature and brain concerning both the neural mechanisms driving the cardiovascular system and the neural consequences of the cardiovascular system dysregulation.

Preferred Research Skills and Competences

The ideal candidate has previous experience in experimental models of cardiovascular diseases and in ex-vivo neural and immune tissues analyses.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.13

Project title: To evaluate the neurobiological mechanisms regulating bitter and sweet taste in rodent models.

ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy
Key words: bitter intake, sweet intake, taste, motivation, hormones
Host Institution: University of Camerino
Reference person/supervisor: Carlo Polidori carlo.polidori@unicam.it
Roberto Ciccocioppo roberto.ciccocioppo@unicam.it

Research topic description. This research aims to investigate the physiology and regulation of sweet and bitter taste perception, focusing on the mechanisms through which gustatory stimuli influence food choice, feeding behavior, and metabolic homeostasis. The project will examine how sweet and bitter taste signals are detected, processed, and integrated with endocrine, metabolic, and behavioral responses that regulate energy balance and nutritional status.
Using rodent models, the study will combine behavioral, physiological, pharmacological, and molecular approaches to determine how acute and chronic exposure to sweet and bitter tastants modifies taste sensitivity, food preference, ingestive behavior, and metabolic adaptations. Particular attention will be devoted to the interactions between peripheral taste receptors, gastrointestinal signaling, circulating hormones involved in appetite regulation, and central mechanisms coordinating feeding responses.

Research team and environment
This research project will be carried out in the Laboratory of Behvaioral Pharmacology, School of Pharmacy, University of Camerino, Italy. The team has established experience in rodent models of ingestive behavior. Reseacher will have access to 1500 m2 of animal facility equipped with metabolic cages, EPM equipments, Porsolt swimming tubes, open field arenas for social interaction, Noldus Etovision system for behavioral monitoring, Equipments for immunohistochemistry, western blot and gine expression analysis are also available.

Preferred Research Skills and Competences
The doctoral candidate will receive training in behavioral pharmacology technique commonly used in basic neuroscience. Candidates with training backgrounds in life sciences, behavioral pharmacologyphysiology, pharmaceutical sciences, are preferentially considered for this position.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.14

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: To study neuronal network dynamics in health and disease

ERC Field: LS5-5 Neuronal network and plasticity, LS5-7 Sensory system LS5_16 Systems and computational neuroscience, LS5_8 — Neural basis of behaviour,, LS5-17 Imaging in neuroscience

Key words: networks dynamics, in vivo, electrophysiology, two photon imaging, excitation, inhibition

Host Institution: Institute of Biophysics, CNR, Pisa

Reference person/supervisor: Claudia Lodovichi claudia.lodovichi@cnr.it

Research topic description

The brain is a complex system, and as such is characterized by emergent properties. This means that neuronal information is encoded not at a single cell level, but by the interactions of the elements of the system. Numerous evidence indicate that correlated neuronal activity within local and wider network in the brain support sensory, cognitive, motor and executive functions. These patterns of activities are highly dynamic, and change according to the status of the subject, the task performed, the sleep/wake cycle and vary along the circadian rhythm. We are interested in analysing brain neuronal activity, in vivo, at systems level, in response to sensory stimulation and distinct behavioural tasks and how these brain rhythms are disrupted in pathological situations. Neuronal activity is critically regulated by inhibitory GABAergic interneurons, whose function is compromised in most brain pathologies. We therefore dedicate particular attention in investigating the contribution of inhibitory response in encoding physiological tasks and dissect how these functions are altered in pathological situations. Due to the dynamics of brain rhythms, we are particularly interested in understanding how brain activity changes along the circadian rhythms. We address this questions by several cutting edge

approaches, in vivo, such as high density electrophysiological recordings, 2 photon imaging, EEG, behaviour, in mice and mouse models of brain disorders, including developmental psyuchiatric disorder and neurodegenerative disease (i.e. Parkinson's disease). The experimental approaches we use generated large dataset that are then analyse we several computational approaches.

Research team and environment

This research project will be carried out at the Institute of Biophysics, CNR, in Pisa. The laboratory headed by Claudia Lodovichi aims at understanding brain neuronal activity in physiological conditions and how these brain rhythms get aberrant in brain disorders. The lab has several cutting-edge equipment such as set ups for high density electrophysiology (Neruopixel), 2 Photon microscope, system for EEG recording in vivo, fiber photometry, miniscopes, cell culture rooms (for basic molecular biology). The lab is composed by researchers, post docs, grand and undergrad students. We have access to the animal facility of the CNR area, where the Institute of Biophysic is located.
The lab's environment is scientifically very rich, dynamics and vivacious. We have several collaborations in Italy and abroad, mostly in UK, France, Denmark, Sweden and USA.

Preferred Research Skills and Competences

The doctoral candidate will be trained in the techniques routinely used in the lab, including electrophysiological recording and 2 photon imaging, and related data analysis which implies programming in Matlab and phyton. Training will also include training in behavioural task and basic molecular biology.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.15

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Unraveling the Pathophysiological Mechanisms of Friedreich's Ataxia to Enable Innovative Therapeutic Strategies

ERC Field: LS5_1 Neural cell function, communication and signalling, neurotransmission in neuronal and/or glial cells; LS7_5 Applied gene and cell therapies, regenerative medicine; LS2_1 Molecular genetics, reverse genetics, forward genetics, genome editing

Key words: Friedreich's ataxia, neurodegeneration, neuronal development and connectivity, neurotrophic factors, gene therapy

Host Institution: CNR-Institute of Neuroscience

Reference person/supervisor: Vania Broccoli **vania.broccoli@cnr.it**

Research topic description
Friedreich ataxia (FA) is an autosomal recessive disorder caused by GAA trinucleotide expansion in the first intron of the ubiquitously expressed Frataxin gene, which lead to its transcriptional silencing and a consequent reduction in Frataxin protein levels. It is the most common form of hereditary ataxia, with an estimated incidence of approximately 1 in 36,000 live births. FA primarily affects the nervous system, but other organs, including the heart and pancreas, are also commonly involved, contributing to a markedly reduced life expectancy, typically ranging between 35 and 50 years of age. One of the earliest pathological features of FA is the selective degeneration of proprioceptive neurons in the dorsal root ganglia (DRG), which represents the primary cause of the characteristic ataxic manifestations. Despite this well-established vulnerability, the biological mechanisms underlying the selective degeneration of peripheral proprioceptive neurons in FA remain poorly understood. This gap in knowledge significantly limits our ability to fully elucidate disease pathogenesis and progression. To overcome this drawback, we generated an inducible frataxin conditional knockout (cKO)

mouse model for the time-specific FXN inactivation. Unexpectedly, while early post-natal Fxn loss leads to ataxia, premature death and neurodegeneration, Fxn inactivation after P35 is without notable effects in the mice. This model provides a powerful new platform to investigate the mechanistic basis of the disease, enabling the elucidation of the chain of events linking Fxn loss to neuronal degeneration. This project will take advantage of this model and patient stem cells to dig into the pathophysiological mechanisms that render DRG neurons particularly vulnerable to this disease. A particular focus will be drawn on neurotrophic factor signaling that is key for survival of these neurons. Moreover, a gene supplementation therapy will be developed for the safe and efficient re-expression of the Fxn gene to rescue neurodegeneration and neurological symptoms.

Research team and environment
The Broccoli Research Lab is dedicated to developing innovative technologies based on stem cells, mouse modelings, and CRISPR/Cas genome editing to improve the modeling and treatment of neurological disorders. We employ complementary experimental systems, including genetically engineered mouse models and patient-derived induced pluripotent stem cells (iPSCs), to recapitulate the key pathophysiological mechanisms underlying human disease. Our group has established a broad range of protocols for the efficient generation of neuronal and glial cell types, enabling rapid and physiologically relevant cellular models of neurological disorders. We have also generated iPSC lines from patients affected by a wide spectrum of diseases, including Dravet syndrome, Rett syndrome, autism spectrum disorders (ASD), neurodegeneration with brain iron accumulation (NBIA), and Parkinson's disease. A major focus of our research is the development of gene-based therapeutic strategies that can be translated into effective treatments for neurological diseases. To enable efficient in vivo gene therapy, we engineer next-generation adeno-associated virus (AAV) vectors with enhanced tissue targeting, broad distribution, and improved safety profiles, providing versatile platforms for precise gene delivery to the nervous system.
The laboratory brings together a dynamic and collaborative team of talented graduate students, postdoctoral fellows, and staff scientists, fostering an intellectually stimulating and supportive environment in which young researchers can thrive.

Preferred Research Skills and Competences
The doctoral candidate will be introduced to molecular studies and mouse models by senior researchers in the lab who have extensive experience with these technologies. S/he will be trained in mouse biology, brain tissue multimodal analyses, molecular techniques and human stem cell cultures. Omics studies are planned to define the transcriptome changes occurring in DRG neurons in the FA mouse model. The student will work together with a bioinformatician in the lab who has developed solid skills in these genome-wide analyses. After initial training, s/he will carry out the project under the direct supervision of the head of unit with whom s/he will have weekly meeting to discuss the planning, execution and interpretation of the ongoing experimental work.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.16

Project title: Uncovering CNS Pathophysiology in Pompe Disease: from Neurodevelopment to Neurodegeneration

ERC Field: LS5 – Neuroscience and Disorders of the Nervous System
Secondary panel (if requested): LS4 – Physiology in Health, Disease and Ageing

Key words: Glia. synapse , metabolism,

Host Institution: CNR Institute of Neuroscience, Milano site

Reference person/supervisor: Chiara Verpelli **chiara.verpelli@in.cnr.it**

Research topic description Pompe disease (PD), also known as glycogen storage disease type II (GSD II) or acid maltase deficiency (AMD), is a rare autosomal recessive disorder caused by mutations in the *GAA* gene,

leading to deficiency of the ubiquitously-expressed lysosomal enzyme acid alpha-glucosidase (GAA). This deficiency results in pathological glycogen accumulation within lysosomes, primarily affecting skeletal, cardiac, and smooth muscle tissues. Over 300 pathogenic GAA variants have been identified.
Premature death in PD is primarily caused by respiratory failure and cardiac issues resulting from lysosomal glycogen accumulation. Without treatment, infantile-onset Pompe disease (IOPD) is usually fatal within the first year of life. Late-onset Pompe disease (LOPD) progresses more slowly, but can still lead to premature death. Indeed, IOPD patients typically have less than 1% residual GAA activity, whereas LOPD patients retain up to 30% residual enzyme function. The estimated birth prevalence is approximately 1:50,000
While PD has long been considered a muscle disorder, increasing evidence indicates central nervous system (CNS) involvement. Glycogen plays a crucial role in brain energy metabolism and is primarily stored in astrocytes, where it supports neuronal activity under conditions of high energy demand or metabolic stress. However, the impact of GAA deficiency on neuronal cells and on CNS function has been poorly investigated.
Since 2006, enzyme replacement therapy (ERT) with alglucosidase alfa has significantly improved patient survival, especially in IOPD. However, ERT does not cross the blood–brain barrier (BBB), resulting in persistent CNS pathology. Long-term survivors increasingly exhibit neurological manifestations, including sensorineural hearing loss, motor impairments, bulbar dysfunction, and cognitive deficits.
These findings underscore a critical unmet need to understand CNS involvement in Pompe disease and develop effective therapeutic strategies targeting the brain.
This project aims to elucidate the mechanisms underlying the involvement of the CNS in PD, focusing on the link between GAA deficiency and neurological dysfunction using a validated mouse model.
Our specific objectives are:
Aim 1: Phenotypic characterization of CNS dysfunction.

- Assess cognitive function, focusing on learning and memory domains, and anxiety behaviours that may be affected but remain underexplored in PD.
- Identify the most informative disease stage for CNS phenotyping, by comparing behavioural outcomes across selected developmental timepoints.

Aim 2: Determine whether CNS defects arise during development or result from progressive degeneration.

- Define a temporal timeline of CNS alterations by systematically characterizing structural and cellular changes across key developmental and adult stages.
- Distinguish development defects from progressive neurodegeneration, by comparing early developmental markers with hallmarks of neuronal loss over time.
- Correlate cognitive and functional deficits with neuronal morphology and synaptic structure.

Aim 3: Investigate the molecular basis of neuronal impairment induced by GAA deficiency in the CNS.

- Identify key molecular pathways disrupted by GAA deficiency in the CNS, focusing on lysosomal function, autophagy, and metabolic stress as potential drivers of neuronal dysfunction.
- Establish a mechanistic link between cellular alterations and behavioural phenotypes.

Research team and environment This research project will be carried out at the Institute of Neuroscience of the Italian National Research Council (CNR), Milan, Italy, in the laboratory headed by Dr. Chiara Verpelli. The laboratory provides a highly interdisciplinary and collaborative environment dedicated to investigating the molecular and cellular mechanisms underlying neurodevelopmental and neurodegenerative disorders, with a particular focus on autism spectrum disorders, intellectual disability, and synaptopathies.
The main research activities of the laboratory focus on understanding how disease-associated genetic variants alter neuronal development, synaptic function, and neural circuit activity, and on identifying novel therapeutic strategies to restore brain function. To achieve these goals, the group integrates complementary experimental approaches, including human induced pluripotent stem cell (iPSC)-derived neuronal models, brain organoids, advanced molecular and cellular biology, mouse genetics, electrophysiology, imaging, and behavioral neuroscience. Particular emphasis is placed on translating mechanistic discoveries into innovative therapeutic approaches, including RNA-based therapeutics and gene-targeted interventions.
The research team currently consists of one postdoctoral fellow, four PhD students, and one Master's student, working in close collaboration with clinicians, geneticists, and international partners. Team members bring expertise spanning molecular neuroscience, stem cell biology, neurodevelopment, genetics, bioinformatics, and translational medicine, creating a dynamic and multidisciplinary research environment.
Researchers have access to state-of-the-art facilities for molecular and cellular neuroscience, including laboratories fully equipped for cell culture, stem cell reprogramming and differentiation, molecular biology, protein biochemistry, confocal microscopy, and high-content imaging. The Institute provides access to advanced genomics and proteomics platforms, next-generation sequencing facilities, bioinformatics support, and animal facilities for the generation and characterization of disease models. Additional infrastructure includes electrophysiological platforms for the study of neuronal activity, behavioral phenotyping facilities, and shared resources for the generation and analysis of human iPSC-derived neurons and brain organoids.

Through its combination of cutting-edge technologies, strong international collaborations, and expertise in disease modeling and therapeutic development, the laboratory offers an outstanding environment for investigating the mechanisms underlying neurological disorders and for developing innovative precision-medicine approaches.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including brain activity recording, imaging, proteomics, behavioural testing, molecular biology, histology and data analysis. In addition, the candidate will gain hands-on experience in human iPSC-based disease modelling, including the generation and characterization of patient-derived neurons and brain organoids for the study of neurodevelopmental and neurodegenerative disorders. Candidates with a background in neuroscience, life sciences, molecular and cellular biology, genetics, biotechnology, biomedical sciences, pharmacology, or related disciplines are encouraged to apply.

Curriculum 4: Computational and System Neuroscience

Code 4.1

Project title:
Investigating the molecular and cellular functions of the autism-associated gene DDX53 using human brain organoids, multi-omics, and AI-driven computational modeling

** Scholarship paid directly by Host Institution and funded under Project code FIS-2024-07592*
Principal Investigator: Marcello Scala
Host Institution: Università degli Studi di Genova
Project title: Multidimensional platform to investigate human genes associated with autism spectrum disorders.
Ref. CUP: D53C25002320001

ERC Fields:
LS5_1 Neuroscience and disorders of the nervous system;
LS2_5 Functional genomics and systems biology;
LS2_10 Stem cells, organoids and developmental biology;
LS2_12 Bioinformatics and computational biology.

Keywords:
Autism Spectrum Disorders, Human Brain Organoids, iPSC, DDX53, Neurodevelopment, Multi-omics, Genome Editing, Artificial Intelligence, Digital Twins, Electrophysiology

Host Institution: University of Genoa

Reference person/supervisor: Bruno Sterlini and Marcello Scala bruno.sterlini@unige.it marcello.scala@unige.it

Research topic description
Autism Spectrum Disorders (ASD) comprise a heterogeneous group of neurodevelopmental conditions characterized by impairments in social communication and the presence of restricted and repetitive behaviors. Although hundreds of genes have been associated with ASD, the biological mechanisms through which many of these genes contribute to human brain development and function remain poorly understood. This limitation is particularly relevant for primate-enriched genes, which are often absent or poorly conserved in conventional animal models.

This project aims to investigate the molecular, cellular and functional role of human ASD-associated genes through an integrated and multidisciplinary strategy combining human induced pluripotent stem cell (iPSC)-derived brain models, multi-omics analyses and computational approaches. The project will be focused on DDX53, a recently identified X-linked gene emerging as a critical contributor to autism in males.
The project will involve the generation and characterization of genetically engineered iPSC lines using CRISPR-based genome editing technologies, followed by the development of advanced two-dimensional neuronal cultures and three-dimensional human brain organoids. These models will be used to investigate the impact of DDX53 dysfunction on human neurodevelopment, neuronal maturation and network activity.
To achieve these objectives, the candidate will employ a broad range of experimental approaches, including molecular and cellular biology, confocal imaging, high-density electrophysiology, transcriptomics, proteomics and functional phenotyping. Multi-omics datasets will be integrated with advanced bioinformatic and artificial intelligence approaches to develop AI-based digital twin models capable of simulating neurodevelopmental trajectories and predicting disease-associated molecular perturbations. The project will primarily focus on *DDX53* as a proof-of-concept gene, but the methodologies developed will establish a scalable platform applicable to the functional characterization of additional ASD-associated genes identified through genomic studies. The ultimate goal of the project is to identify novel molecular pathways underlying ASD pathogenesis, establish scalable human platforms for functional genomics studies, and contribute to the development of future precision medicine approaches for neurodevelopmental disorders.

Research team and environment
The project will be carried out at the Human Brain Models Laboratory within the Neurophysiology Section of the Department of Experimental Medicine of the University of Genoa.
The laboratory is closely integrated with the Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics and Maternal and Child Health, the IRCCS Ospedale Policlinico San Martino and the Center for Synaptic Neuroscience of the Italian Institute of Technology, creating a highly interdisciplinary research environment focused on translational neuroscience and human disease modeling.
Researchers have access to state-of-the-art facilities for stem cell biology, genome engineering, advanced microscopy, electrophysiology and omics technologies. Available platforms include high-density and low-density multi-electrode array systems, patch-clamp electrophysiology, live-cell imaging systems, confocal microscopy, fluorescence-activated cell sorting (FACS), single-cell and bulk transcriptomics platforms, proteomics facilities and dedicated bioinformatics and computational biology infrastructures.
The Human Brain Models Lab hosts a multidisciplinary team of researchers, postdoctoral fellows, PhD students and clinicians working at the interface of neuroscience, stem cell biology, genomics, bioengineering and computational modeling. The laboratory has extensive expertise in the development of human iPSC-derived neuronal cultures, cerebral organoids and advanced functional phenotyping platforms for neurodevelopmental and neurodegenerative disorders. The PhD candidate will benefit from an international collaborative network involving experts in medical genetics, stem cell biology, computational biology, and neurodevelopmental disorders, with opportunities for interdisciplinary training and translational research.

Preferred Research Skills and Competences
The doctoral candidate will receive advanced training in the generation and characterization of human brain models, including iPSC culture, neuronal differentiation, brain organoid technology, genome editing, electrophysiology, imaging, molecular biology, transcriptomics, proteomics and computational data analysis. Candidates with a background in life sciences, neuroscience, data analysis, machine learning, electrophysiology, CRISPR-mediated genome editing, stem cell biology, or related disciplines will be preferentially considered for this position.

Curriculum 4: Computational and System Neuroscience

Code 4.2

Project title: Motor prediction and error observation

ERC Fields:
LS5_1 Neuroscience and disorders of the nervous system;
LS2_12 Bioinformatics and computational biology.

Keywords:

Sensorymotor system movement, brain computer interface

Host Institution: University of Bologna

Reference person/supervisor: Patrizia Fattori patrizia.fattori@unibo.it

Our laboratory is aimed at investigating the neural mechanisms of sensorimotor integration in physiological conditions. We also want to exploit this knowledge to inform new technologies so to assist patients with deficits in these functions.

Several lines of research are present in the lab. More info can be found here:

https://site.unibo.it/fattori-lab/en/research-interests-1/neuroscience-of-the-medial-ppc

https://site.unibo.it/fattori-lab/en/research-interests-1/neural-circuits

https://site.unibo.it/fattori-lab/en/research-interests-1/psychophysics-in-human

https://site.unibo.it/fattori-lab/en/research-interests-1/neural-mechanisms-in-human

Research team and environment

This research project will be carried out in the Department of Biomedical and Neuromotor Sciences, University of Bologna, Italy. The laboratory is headed by Prof. Patrizia Fattori and is conceived as a multidisciplinary environment to investigate complex questions in systems neuroscience.

Several national and international projects are running, so the PhD students will be put in contact with different national and international research teams.

Details on the research activities lead by Fattori can be found at: https://site.unibo.it/fattori-lab/en

Curriculum 4: Computational and System Neuroscience

Code 4.3

**1 PhD position to be awarded in the framework of the Commitment by the University of Changchun is reserved to candidates graduated from Changchun University of Technology*

Project title: Computational Modeling of Reinforcement, Motivation, and Drug-Seeking Behavior in Rodents

ERC Field: LS5: Neurosciences and Neural Disorders: Neurobiology, neuroanatomy, neurophysiology, neurochemistry, neuropharmacology, neuroimaging, systems neuroscience, neurological and psychiatric disorders

Key words: Reward, modelling, neurocircuits, reinforcement, rodent

Host Institution: University of Camerino

Reference person/supervisor: Roberto Ciccocioppo roberto.ciccocioppo@unicam.it

Project decsription: We aim to develop and utilize computational models to simulate and analyze the reinforcing, motivational, and drug-seeking effects of drugs of abuse. By integrating data from molecular

biology and immunohistochemical techniques, as well as Designer Receptors Exclusively Activated by Designer Drugs (DREADD) experiments, we will explore the neurocircuitry-level consequences of prolonged drug exposure. Our goal is to understand how the manipulation of neural circuits involved in the regulation of motivated behavior and emotion modulates seeking and taking responses for drugs of abuse compared to natural reinforcers. By structuring this project into a neurocomputational framework, we aim to leverage the power of computational models to gain deeper insights into the complex dynamics of drug-seeking behavior and its underlying neural mechanisms.

Research team and environment: This research project will be carried out in the School of Pharmacy, Center for Neuroscience, University of Camerino, Italy. The laboratory headed by Prof. Roberto Ciccocioppo is conceived as a multidisciplinary environment to investigate complex questions in the field of neuroscience, advancing the understanding of the molecular basis of neuropsychiatric and neurodegenerative disorders.

Preferred Research Skills and Competences
Candidates with training backgrounds in life sciences, with experience in computational neuroscience While experience in in vitro electrophysiology is not required, it is highly appreciated.

Curriculum 4: Computational and System Neuroscience

Code 4.4

Project Title: Development of Medical devices for e-Health and Innovative diagnostics for precision medicine.
ERC Field: PE6_11 Machine learning, statistical data processing and applications using signal processing; PE6_12 Scientific computing, simulation and modelling tools; LS5_2 Systems neuroscience and computational neuroscience.
Key words: Diagnostics for brain disorders; electronics, machine learning, coding.
Host Institution: University of Camerino
Reference person/supervisor: Massimo Ubaldi massimo.ubaldi@unicam.it

Research topic description
The main goal of this project is to develop innovative, contactless, and non-invasive diagnostic sensors for use in healthcare with focus on brain disorders. A secondary objective is to enhance community healthcare by equipping it with advanced tools that improve the management of healthcare services. The development of sensor systems for remote diagnostics would enhance home health monitoring capabilities, thereby reducing pressure on hospital and outpatient services. Contactless, non-invasive sensors enable the acquisition of information related to the subject under examination without requiring them to perform particularly complex actions. The operating principle of these sensors is based on the processing of both radar (radio frequency) and three-dimensional video signals. The application of appropriate artificial intelligence algorithms allows the extraction of characteristics of interest of the individual under examination, both from a physiological and behavioral or movement-related perspective. Information can be deduced regarding the subject's ability to walk, any falls or tremors, as well as information related to simple daily gestures that can monitor the state of health, both physical and mental.
The prototype sensor will be developed by testing its capacity in laboratory animals and then tested in humans. The project is reserved to AM-Microsystem employe

Research team and environment
The University of Camerino will provide the research laboratories of the School of Pharmaceutical and Health Products Sciences, which feature cutting-edge diagnostic and analytical equipment. AM-Microsystem will provide the technology for sensor development

Preferred Research Skills and Competences

The ideal candidate with a background in engineering, computer science, physics with computational and programming skills (ideally, knowledge of Matlab and/or Python) are evaluated favorably. The ideal candidate is expected to show ability to work independently in a highly collaborative environment.

Curriculum 4: Computational and System Neuroscience

Code 4.5

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Sensory Neurotechnologies for Standing, Balance, and Locomotion after Spinal Cord Injury

ERC Field:
LS7 – Prevention, Diagnosis and Treatment of Human Diseases, LS5 – Neurosciences and Neural Disorders, PE7 – Systems and Communication Engineering, PE6 – Computer Science and Informatics
Key words:
Spinal Cord Injury, Neurostimulation, Sensory Feedback, Balance, Locomotion, Rehabilitation, Wearable Neurotechnology

Host Institution: IRCCS Ospedale San Raffaele
Reference person/supervisor:
Solaiman Shokur Solaiman.shokur@santannapisa.it
Silvestro Micera silvestro.micera@santannapisa.it

Research topic description
Restoring locomotion after spinal cord injury has become one of the major achievements of modern neurotechnology. Epidural spinal cord stimulation has enabled individuals with severe paralysis to regain stepping abilities and perform assisted walking, opening new perspectives for rehabilitation. However, standing balance and postural stability remain major limitations that continue to restrict independence during activities of daily living.
This PhD project aims to develop wearable sensory neurotechnologies capable of restoring artificial proprioceptive and postural feedback to improve standing stability, balance, locomotion, and rehabilitation in individuals with spinal cord injury. Rather than focusing exclusively on motor stimulation, the project will investigate how artificial sensory information can be integrated with residual neural circuits to enhance postural control and facilitate more natural motor behaviour.
The candidate will design and evaluate multimodal sensory feedback systems combining wearable sensors, biomechanical measurements, virtual reality, and electrical stimulation. These technologies will be integrated with state-of-the-art epidural spinal cord stimulation to investigate how sensory augmentation influences standing, balance recovery, gait initiation, and locomotion under both laboratory and clinically relevant conditions.
The research will combine quantitative assessment of human movement using motion capture, force platforms, wearable inertial sensors, and computational analysis of postural control with translational studies involving individuals with spinal cord injury. Particular emphasis will be placed on developing adaptive feedback strategies capable of responding in real time to changes in posture and movement, paving the way toward next-generation closed-loop neurorehabilitation systems.
By combining sensory neuroengineering, rehabilitation neuroscience, and clinical translation, the project seeks to establish new neurotechnological approaches that improve mobility and promote greater independence for individuals living with paralysis.

Research team and environment
This research project will be carried out at the BioRobotics Institute of Scuola Superiore Sant'Anna (SSSA), within the Modular Implantable Neural Engineering (MINE) Lab, based at Ospedale San Raffaele in Milan, Italy—one of the largest and most prestigious private hospitals in the country. The MINE Lab is co-led by Prof. Silvestro Micera and Prof. Pietro Mortini and is dedicated to the development and clinical validation of neurotechnologies that restore motor and sensory functions in individuals with severe impairments, such as spinal cord injury and limb amputation. Prof. Solaiman Shokur is head of the sensorimotor neurotechnology team in the MINE lab.
The MINE Lab brings together physiotherapists, neurosurgeons, senior neuroengineers, clinicians, and PhD students, creating a highly interdisciplinary research environment. Researchers have access to state-of-the-art

rehabilitation facilities, robotic devices, motion capture systems, force platforms, wearable sensing technologies, EEG and EMG acquisition systems, and ongoing first-in-human clinical studies involving spinal cord stimulation and advanced neurorehabilitation.

Preferred Research Skills and Competences
The doctoral candidate will receive training in translational neural engineering, neurostimulation, wearable sensing, biomechanics, rehabilitation robotics, and clinical neuroscience. The project offers the opportunity to work at the interface between engineering, neuroscience, and medicine while contributing to the development of next generation neurotechnologies for restoring mobility after spinal cord injury.
Candidates with a background in biomedical engineering, robotics, electrical engineering, neuroengineering, computer science, or related disciplines are encouraged to apply.

Curriculum 4: Computational and System Neuroscience

Code 4.6

**subject to confirmation – (this position may not be awarded, depending on funding and administrative issues that are still pending)*

Project title: Personalized Peripheral Nerve Stimulation for Finger Dexterity Recovery in Stroke Patients
ERC Field:
LS7 – Prevention, Diagnosis and Treatment of Human Diseases PE7 – Systems and Communication Engineering LS5 – Neurosciences and Neural Disorders PE6 – Computer Science and Informatics
Key words:
Stroke Rehabilitation, Peripheral Nerve Stimulation, Neuroprosthetics, Computational Modeling, Machine Learning, Finger Dexterity, Neuroengineering

Host Institution: IRCCS Ospedale San Raffaele
Reference person/supervisor:
Silvestro Micera silvestro.micera@santannapisa.it
Solaiman Shokur Solaiman.shokur@santannapisa.it

Research topic description
Stroke is one of the leading causes of long-term upper-limb disability, leaving millions of individuals with persistent impairments in hand and finger function despite intensive rehabilitation. Although functional electrical stimulation has demonstrated considerable potential to restore movement, current approaches often rely on non-selective muscle stimulation, limiting dexterity and requiring lengthy manual calibration. Conversely, highly personalized neuroprosthetic solutions remain difficult to optimize and deploy in routine clinical practice. There is therefore a critical need for neurotechnologies that combine highly selective motor restoration with practical clinical implementation.
This PhD project aims to develop personalized peripheral nerve stimulation strategies capable of restoring functional hand and finger movements after stroke. The project will investigate how patient-specific computational models can be used to optimize electrode placement and stimulation protocols for multi-contact cuff electrodes implanted around branches of the median and radial nerves, enabling selective activation of individual muscles responsible for functional grasp and finger movements.
The candidate will develop hybrid computational models integrating anatomical imaging, peripheral nerve electrophysiology, musculoskeletal biomechanics, and electromyographic recordings to predict optimal stimulation strategies for each individual. These models will be combined with machine-learning and optimization algorithms capable of automatically identifying stimulation parameters that maximize motor recovery while minimizing fatigue, unwanted muscle recruitment, and calibration time.
The proposed framework will be validated through benchtop experiments and translational studies involving individuals with stroke, combining quantitative assessments of muscle activity, kinematics, and functional performance. By integrating computational neuroengineering with peripheral nerve stimulation, the project aims to establish a new generation of personalized neurorehabilitation technologies that bridge the gap between highly selective motor restoration and scalable clinical implementation.

Research team and environment

This research project will be carried out at the BioRobotics Institute of Scuola Superiore Sant'Anna (SSSA), within the **Modular Implantable Neural Engineering (MINE) Lab**, based at Ospedale San Raffaele in Milan, Italy—one of the largest and most prestigious private hospitals in the country. The MINE Lab is co-led by Prof. Silvestro Micera and Prof. Pietro Mortini and is dedicated to the development and clinical validation of neurotechnologies that restore motor and sensory functions in individuals with severe impairments, such as spinal cord injury and limb amputation. Prof. Solaiman Shokur is head of the sensorimotor neurotechnology team in the MINE lab.
The MINE Lab brings together physiotherapists, neurosurgeons, senior neuroengineers, clinicians, and PhD students, creating a highly interdisciplinary research environment. Researchers have access to state-of-the-art rehabilitation facilities, robotic devices, motion capture systems, force platforms, wearable sensing technologies, EEG and EMG acquisition systems, and ongoing first-in-human clinical studies involving spinal cord stimulation and advanced neurorehabilitation.

Preferred Research Skills and Competences
The doctoral candidate will receive advanced training in computational neuroengineering, peripheral nerve stimulation, machine learning, biomechanical modeling, neurophysiology, and translational neurotechnology. The project offers the opportunity to work at the interface between engineering, neuroscience, and clinical rehabilitation while contributing to the development of next-generation Neuroprosthetic therapies for restoring hand function after stroke.
Candidates with a background in biomedical engineering, neuroengineering, robotics, electrical engineering, computer science, computational biomechanics, or related disciplines are encouraged to apply.