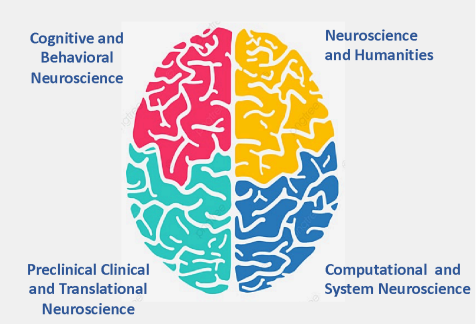
Theoretical and Applied Neuroscience

Research PhD Program



Cycle 41°

Academic year 2025-2026

List of the Research Topics

Curriculum	Research Project	Host Institution	Number of fellowships/ type
Curriculum 1: Cognitive and Behavioral Neuroscience			
1.1	Neuroscience of Wellbeing and Cognitive Performance	IMT School for Advanced Studies Lucca	1 Scholarship Funded under the project code P0378 (CUP D63C24000960007)
1.2	The impact of early motor deprivation on bodily self representation	University of Turin	1 Cargest SA Grant 2024 BORN, GARF_RIC_N_COMP_24_01_F, CUP: D13C23004030007
1.3	To study novel neuromodulation approaches based on sensorimotor adaptation in neurological and neurodevelopmental disorders	University of Palermo	1
1.4	Music perception in nonhuman primates	CNR	1 *subject to confirmation
1.5	The perception of consonant and dissonant ratios in audition, vision and touch	CNR	1 *subject to confirmation
1.6	Cognitive and behavioural investigation of musical consonance and dissonance across cultures	CNR	1 *subject to confirmation
Curriculum 2: Neuroscience and Humanities			
2.1	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 ERC Advanced Grant 2017 eHONESTY, Grant Number 789058, CUP B86C18002710006
2.2	Probing the contribution of INTERnal bodily signals to the performance monitoring of others' ACTions	Sapienza University of Rome – Department of Psychology	1 Starting Grant FIS-2023-03019 - Project Code (CUP): B53C24009640001
2.3	A neuro-socio-cognitive framework to understand the role of threat processing in ideological extremism	University of Messina	1
2.4	Internal and external body states for self-awareness and social interactions	IRCSS Sacro Cuore/ Università di Verona	1* Executive position reserved to IRCSS Sacro Cuore employees

2.5	Studying the effects of Virtual Reality training for the rehabilitation of social skills in neurodevelopmental disorders	Scientific Institute, IRCCS MEDEA	1
Curriculum 3: Preclinical, Clinical and Translational Neuroscience			
3.1	To study the neurobiological, behavioral and pharmacological basis of drug addiction and chronic pain: Focus on the opioid system.	University of Camerino	2* * 1 reserved to the specific agreements with Chinese Universities
3.2	To evaluate the neurobiological mechanisms regulating NaCl and water intake in rodent models.	University of Camerino	2
3.3	Innovative Pharmacological and Nutraceutical Strategies for Neuroprotection and Cognitive Health Support	University of Camerino	2* * Executive positions reserved to Neurastem employees or PhD higher education apprentices to be hired
3.4	Neurobiological, behavioral, and pharmacological basis of attention deficit hyperactivity disorder, substance abuse, and related psychopathologies.	University of Camerino	1
3.5	Translational strategies leveraging neurotechnology to address long-term motor and cognitive sequelae in post-critical illness across care settings	University of Brescia	1
3.6	Multibrain Dynamics in Aberrant Emotion Discrimination	Istituto Italiano di Tecnologia	1
3.7	Studying the role of sleep loss in the development of neuropsychiatric disorders: a focus on adolescent brain connectivity and alcohol use	University of Camerino	1
3.8	Multimodal electrostimulation to improve walking and stability in people with lower limb paralysis.	Scuola Superiore Sant'Anna	1
3.9	Targeting potassium channels for personalized treatment of neurodevelopmental diseases	University of Naples Federico II	1
3.10	To study the role of the ghrelin system to develop new neutraceutical to treat depression and reward related disorders	University of Camerino	2 Executive positions reserved to Biotecnica employees or PhD higher education apprentices to be hired
3.11	Sex-differences in the neurobiology of memory decline and treatments	Institute of Biochemistry and Cell Biology (IBBC), CNR & Telethon Institute of Genetics and Medicine (TIGEM), Telethon Foundation ETSa & University of Camerino	1 Position with no fellowship *subject to confirmation
3.12	Multiple Sclerosis: From Animal Models to Human Studies	University of Cagliari	1

3.13	Decipher the neural basis of impaired learning and memory in vascular cognitive impairment through a mouse model of hypertension induced cognitive impairment	Sapienza University of Rome – Department of Medical-Surgical Sciences and Biotechnologies	1 Position with no fellowship
3.14	Next-generation nutraceuticals for supporting brain health	University of Camerino	1* *Fellowship: Dottorato Innovativo Regione Marche
Curriculum 4: Computational and System Neuroscience			
4.1	Neurobehavioral fingerprinting of schizophrenia via self-supervised learning in deep neural networks	University of Ferrara	1
4.2	Structural and biological properties of α-synuclein aggregates in Parkinson's disease.	University of Naples Federico II	1 Starting Grant FIS-2023-00724 - Project Code (CUP): E53C24003680001
4.3	Multimodal analysis of the sensorimotor functions using machine learning techniques	University of Bologna	1 Progetto "NeuroRobCoRe -(Provvedimento CNR-STIIMA prot. n. 196844 del 03/06/2025) - CUP B53C2200695000
4.4	Investigating sleep-like dynamics and cortical connectivity in focal brain injury through invasive recordings in humans	University of Milan	1 ERC-2022-SYG Grant number 101071900 neurological mechanisms of injury and sleep-like cellular dynamics (NEMESIS) CUP C93C23004980007
4.5	Investigating sleep-like dynamics and cortical connectivity in focal brain injury through non-invasive recordings in humans	University of Milan	1 ERC-2022-SYG Grant number 101071900 neurological mechanisms of injury and sleep-like cellular dynamics (NEMESIS) CUP C93C23004980007
4.6	Development of Medical devices for e-Health and Innovative diagnostics for precision medicine	University of Camerino	2 Executive positions reserved to Am-microsystem employees or PhD higher education apprentices to be hired

4.7	Computational Modeling of Reinforcement, Motivation, and Drug-Seeking Behavior in Rodents	University of Camerino	1 Reserved to the specific agreements with Chinese Universities
4.8	**A**dvanced neuroimaging approaches to characterize the cerebral glymphatic system injury in cardiovascular diseases and vascular dementia	Sapienza University of Rome - Department of Medical-Surgical Sciences and Biotechnologies	1 Position with no fellowship

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.1

Scholarship Funded under the project code P0378 (CUP D63C24000960007)

Host University/Research Institution: IMT School for Advanced Studies Lucca

ERC Field: SH4 The Human Mind and its complexity: cognition, psychology, linguistics, philosophy and education
Project title:
Neuroscience of Wellbeing and Cognitive Performance
ERC Field:
SH4 – The Human Mind and its complexity: cognition, psychology, linguistics, philosophy and education
Key words:
cognitive performance, wellbeing, neurophysiology, EEG, biofeedback, psychophysiology

Host Institution:
IMT School for Advanced Studies Lucca

Reference person / supervisor: Prof. Giacomo Handjaras giacomo.handjaras@imtlucca.it

Research topic description:
This research project explores the cognitive and psychophysiological mechanisms that support mental wellbeing and human performance. It aims to understand how neural, physiological, and behavioral indicators can be used to assess, model, and potentially optimize individual cognitive functions in various contexts.
The PhD candidate will be trained in advanced experimental methodologies, including functional and structural neuroimaging (MRI), electrophysiological recording (EEG), and the acquisition and analysis of peripheral biosignals (e.g., ECG, PPG, GSR). Research activities may include the design and implementation of laboratory and field studies that investigate attention, mental fatigue, learning, and resilience from a neuroscience perspective.
The candidate will work in the research environment of the MoMiLab (Molecular Mind Laboratory), which integrates basic neuroscience methods with experimental psychophysiology and neuroimaging techniques. The research falls within the scope of the ERC SH4 domain "The Human Mind and Its Complexity," and will benefit from a multidisciplinary and integrated approach.

Research team and environment:
The host institution, IMT School for Advanced Studies Lucca, is one of the six Italian Schools of Excellence and is consistently among the top-rated graduate schools in Europe (U-Multirank). It provides high-level training and close scientific supervision across a variety of disciplines, promoting both multidisciplinarity and interdisciplinarity at the interface of social sciences, humanities, and technological/natural sciences.

The PhD candidate will have access to the Multidisciplinary Laboratory (equipped for EEG, psychophysics, and psychophysiological measures), the joint Neuroscience Lab with Intesa Sanpaolo Innovation Center, and external MRI facilities ranging from 1.5T to 7T in Pisa and Massa. Training will include participation in seminars and collaborative projects across domains such as computational modeling, behavioral sciences, and neuroscience of complex systems.

Preferred Research Skills and Competences:
Candidates with backgrounds in psychology, cognitive neuroscience, biomedical engineering, or data science are encouraged to apply. Experience with neuroimaging data analysis, biosignal processing, experimental design, and statistical/computational skills (e.g., MATLAB, Python, R) will be considered a plus.

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.2

Scholarship Funded under Cargest SA Grant 2024 BORN, GARF_RIC_N_COMP_24_01_F, CUP: D13C23004030007

Project title: The impact of early motor deprivation on bodily self-representation .
ERC Field: SH4_4 Neuropsychology
Key words: Bodily-self representation, motor deprivation, cerebral palsy, multisensory integration, neuropsychological patients
Host Institution: University of Turin

Reference person/supervisor: Francesca Garbarini francesca.garbarini@unito.it

Research topic description
Bodily-self representation (BSR), defined as the ability to perceive one's body as a distinct entity in the environment, is fundamental to the construction of an early sense of self. However, how BSR emerges and develops remains largely unknown. This project aims to characterize the crucial role of the motor context in shaping the developmental trajectories of BSR from early infancy, in both typical and atypical populations (e.g., cerebral palsy). Individuals with congenital or acquired motor deprivation will be tested by combining psychophysical paradigms with neuroimaging techniques. The project's results will allow to shed light on the neural mechanisms underlying the emergence of early multisensory body representations. The project will be supported by Carigest SA.

Research team and environment
The research project will be carried out at the Department of Psychology (University of Turin), under the supervision of Prof. Francesca Garbarini. The MANIBUS Lab (i.e., Francesca Garbarini's research laboratory) is conceived as a multidisciplinary environment that focuses both on basic and applied research, employing psychophysiological techniques to measure the relationship between brain and behaviour in both normal and pathological contexts. Furthermore, the MANIBUS Lab has access to a research environment that is ideally rich in facilities. In particular, the group has access to the new research infrastructure Human Science and Technologies (HST; director and coordinator: Prof. Francesca Garbarini; website: https://www.hst.unito.it/home-page), which holds innovative techniques (e.g., VR tools, high-density electroencephalography, high-density near-infrared spectroscopy, motion capture systems) as well as multidisciplinary expertise thanks to the variety of Departments of the University of Turin collaborating in the center (e.g., Informatics, Psychology, Neuroscience, Medical Science).

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including neuroimaging (fNIRS), psychophysiological (EEG, EMG, skin conductance, and heart rate) and movement tracking (eye-tracking and kinematics) techniques, as well as virtual reality or real-life cognitive assessment tools. The successful candidate should have a background in Psychology, Neuroscience, or related disciplines. Previous research experience within the neuropsychological context with brain-damaged patients, as

well as with developmental samples, will be highly valued. Previous experience multisensory integration paradigms and psychophysiological recordings within such contexts will also be appreciated.

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.3

Project title: To study novel neuromodulation approaches based on sensorimotor adaptation in neurological and neurodevelopmental disorders
ERC Field: LS5_5 LS5_5 Neural bases of cognitive processes (e.g. memory, learning, attention)
Key words: Neuromodulation, Sensorimotor Adaptation, Cogniitve, Neurodevelopmental disorders
Host Institution: University of Palermo
Reference person/supervisor: Patrizia Turriziani patrizia.turriziani@unipa.it

Research topic description
Cognitive disorders, following both neurological diseases and neurodevelopmental disorders, present significant challenges due to their complex etiologies and limited treatment options. In recent years, neuromodulation has emerged as a promising set of techniques for altering neural activity and enhancing cognitive function. Approaches such as transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS) offer targeted, non-pharmacological interventions that can modulate dysfunctional neural circuits involved in cognition, attention, memory, and executive control.
Alongside these technologies, there is growing interest in the use of sensorimotor adaptation paradigms traditionally applied in motor rehabilitation—as tools to indirectly influence cognitive processing. These paradigms, such as prism adaptation and visuomotor rotation, engage distributed brain networks that overlap with those implicated in higher-order cognitive functions. Recent studies suggest that engaging sensorimotor adaptation can induce plastic changes in frontal and parietal cortices, areas also involved in attention, spatial reasoning, and executive functioning. This convergence raises the intriguing possibility that sensorimotor adaptation could serve as a novel neuromodulatory strategy for cognitive enhancement, particularly in populations with cognitive deficits stemming from neurological, psychiatric or neurodevelopmental disorders.
Our laboratory is aimed at investigating the dynamic interplay between visuomotor adaptation and cognitive functions, with the ultimate objective of opening new avenues for therapeutic interventions that are low-cost, accessible, and potentially synergistic with existing neuromodulatory methods.
To exploit these projects, in addition to classical neuromodulation approaches such as TMS and tDCS, different visuomotor adaptation paradigms will be developed and tested in both healthy subjects and clinical populations.

Research team and environment
This research project will be carried out in the neuropsychology lab of the Department SPPEF, in collaboration with the Department BIND, of the University of Palermo, Italy.
The laboratory, headed by Prof. Patrizia Turriziani, is conceived as a multidisciplinary environment to investigate complex questions in cognitive neuroscience and neuropsychology.
The main research focus of the laboratory is on the study of the cognitive and neural architecture of processes like memory, attention, language, executive functions.
Most of this work is directed not only at the understanding the neurophysiological mechanisms responsible for the development of cognitive and behavioural deficits but also at identifying innovative effective treatments based on non-invasive modulation of specific brain circuits.
Over the years this research team contributed to the development of novel treatment approaches for attentional, memory and executive deficits in different clinical populations, as well as to the development of novel medical devices for cognitive rehabilitation.
The team consists of several researchers, post-doctoral fellows and PhD students. Researchers have access to instruments like TMS, tDCS, EEG, digital prism adaptation and to clinical environments examining over 1000 patients per year, ranging from neurological diseases like Alzheimer's disease to neurodevelopmental disorders like autism spectrum disorder and attention deficit and hyperactivity disorder.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most used in cognitive neuroscience and neuropsychology, including neuropsychological assessment, brain activity recording through EEG, neuromodulation through TMS and tDCS, visuomotor adaptation through prismatic lenses. Interactions with medical companies developing digital medical solutions will also be favoured.
Candidates with training backgrounds in psychology and life sciences are preferentially considered for this position

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.4

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

Project title: Music perception in nonhuman primates

ERC Field SH4_1 Cognitive basis of human development, developmental disorders; comparative cognition;
Key words: Capuchin monkeys; music perception and cognition; evolutionary musicology.
Host Institution National Research Council (CNR)
Reference person/supervisor Nicola Di Stefano nicola.distefano@istc.cnr.it

Research topic description
Behavioural studies have addressed consonance perception in nonhuman primates. Together with studies on other animal species (e.g., birds and rats), these results suggest that consonance perception might rely on certain acoustic features of biological sounds in natural environments. Given that pitch processing is one of the core components of musicality, investigating consonance perception in nonhuman animals turns out to be an essential part of this cross-species research agenda. Crucially, however, while different species of primates have been involved in consonance studies (such as chimpanzees, Tamarin monkeys, Campbell's monkeys), no study has ever tested capuchin monkeys, a species that shares several cognitive and behavioural traits with humans. The Phd candidate will gather critical data on capuchin monkeys' perception of consonance, thus contributing to the research on the evolutionary origins of musicality.

Research team and environment
This research project will be carried out at the Institute of Cognitive Sciences and Technologies (ISTC), National Research Council of Italy (CNR), Rome. The ISTC is a highly interdisciplinary environment devoted to investigating complex questions across several fields, ranging from psychology and philosophy to robotics and artificial intelligence. The research team, led by Nicola Di Stefano, involves several researchers with different backgrounds, including philosophy, psychology, data science, and musicology. Crucially, the unit of primatology at ISTC will provide fundamental facilities for carrying out the research program.

Preferred Research Skills and Competences The doctoral candidate will receive broad training in cognitive and behavioural neuroscience, with a specific focus on music perception and cognition. Candidates with an academic background in musicology or psychology, or related fields, are preferentially considered for this position.

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.5

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

Project title: The perception of consonant and dissonant ratios in audition, vision and touch

ERC Field SH4_5 Attention, perception, action, consciousness; SH8_7 Music and musicology; history of music
Key words: Musical consonance and dissonance; Crossmodal perception; Multisensory perception
Host Institution National Research Council (CNR)
Reference person/supervisor Nicola Di Stefano nicola.distefano@istc.cnr.it

Research topic description
In research on musical consonance and dissonance, a long line of influential studies has assessed preferences for different pitch combinations among listeners. Previous works have suggested that a common mechanism may be responsible for driving preference in pitch and rhythm perception, but less work has explored the perception of sequences of different rhythmic streams. Beyond audition, the perception of "visual rhythms" has been investigated since the beginning of the last century, with results suggesting that the principles of rhythmic organization are of the same nature in vision, audition, and, to some extent, touch. Findings have confirmed similarities between auditory and tactile rhythm perception. Surprisingly, though, no study has ever addressed the perception of C/D ratios across the senses. The Phd candidate will gather novel data on the multi- and cross-modal perception of consonant ratios when these are realized as the combination of auditory rhythms (i.e., metronome clicks), visual rhythms (i.e., flashing lights), and tactile rhythms (i.e., tactile stimulations).

Research team and environment
This research project will be carried out at the Institute of Cognitive Sciences and Technologies (ISTC), National Research Council of Italy (CNR), Rome. The ISTC is a highly interdisciplinary environment devoted to investigating complex questions across several fields, ranging from psychology and philosophy to robotics and artificial intelligence. The research team, led by Nicola Di Stefano, involves several researchers with different backgrounds, including philosophy, psychology, data science, and musicology.

Preferred Research Skills and Competences The doctoral candidate will receive broad training in cognitive and behavioural neuroscience, with a specific focus on music perception and cognition. Candidates with an academic background in psychology, or systematic musicology, or related fields are preferentially considered for this position.

Curriculum 1: Cognitive and Behavioral Neuroscience

Code 1.6

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

Title: Cognitive and behavioural investigation of musical consonance and dissonance across cultures

ERC Field: SH8_7 Music and musicology; history of music; SH4_5 Attention, perception, action, consciousness;
Key words
Host Institution National Research Council (CNR)
Reference person/supervisor Nicola Di Stefano nicola.distefano@istc.cnr.it

Research topic description
Scholars have suggested that enculturation, individual experience, and music training affect listeners' perception of consonance and dissonance. However, an unbiased and finegrained analysis of how cultures affect C/D perception is lacking due to the fact that most research involved WEIRD (White, Educated, Industrialized, Rich, and Democratic) participants, used experimental materials typically drawn from Western music, and investigated constructs that are relevant to Western music. Few cross-cultural studies have recently provided critical findings on the perception of consonance and dissonance in relatively small samples of non-Western listeners. However, due to the different methodologies adopted (e.g., different stimuli and tasks), those studies are hardly comparable and generalizable.
The Phd candidate will run a large cross-cultural investigation on consonance/dissonance perception, thus providing a uniquely rich, comprehensive, and open database on the perception of consonance across nations, languages, and cultures.

Research team and environment
This research project will be carried out at the Institute of Cognitive Sciences and Technologies (ISTC), National Research Council of Italy (CNR), Rome. The ISTC is a highly interdisciplinary environment devoted to investigating complex questions across several fields, ranging from psychology and philosophy to robotics and artificial intelligence. The research team, led by Nicola Di Stefano, involves several researchers with different backgrounds, including philosophy, psychology, data science, and musicology.

Preferred Research Skills and Competences The doctoral candidate will receive broad training in cognitive and behavioural neuroscience, with a specific focus on music perception and cognition. Candidates with an academic background in musicology or psychology, or related fields, are preferentially considered for this position.

Curriculum 2: Neuroscience and Humanities

Code 2.1

Scholarship Funded under the project ERC Advanced Grant 2017 eHONESTY, Grant 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

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 2: Neuroscience and Humanities

Code 2.2

Ministero dell'Università e della Ricerca

FIS

Scholarship Funded under the project Starting Grant FIS-2023-03019 - Project Code (CUP):B53C24009640001

2.2 Project description:

Project title: Probing the contribution of INTERnal bodily signals to the performance monitoring of others' ACTions, Funded by: Italian Ministry of University and Research– FIS2 Starting Grant, Project Code (CUP): B53C24009640001, Principal Investigator: Dr. Vanessa Era

ERC Field: SH4 - The Human Mind and Its Complexity; SH4_4 - Neurocognitive psychology; SH4_2 Personality and social cognition; emotion

Key words: Interoception, Brain-body communication, Interpersonal motor interactions, Interpersonal performance monitoring, gastric activity

Host Institution: Sapienza University of Rome

Reference person/supervisor: Vanessa Era; vanessa.era@unriroma1.it
Research topic description: This research project investigates the neural and physiological mechanisms underlying interpersonal coordination, with particular attention to how internal bodily states influence the monitoring and adaptation to others' actions. Developed within the *Neuroscience and Humanities* curriculum of the National PhD Program in Theoretical and Applied Neuroscience, the study bridges social neuroscience and philosophy of mind to promote a more integrated understanding of human interaction. Grounded in theories of embodied cognition, the project explores how cardiac and gastric physiology contribute to interpersonal synchronization. It adopts a multimodal methodology that combines electroencephalography (EEG), electrocardiography (ECG), electrogastrography (EGG) to monitor real-time dynamics between the brain, heart, and stomach. To investigate the causal role of brain–body interactions in social coordination, the project uses non-invasive stimulation techniques such as transcranial direct current stimulation (tDCS), transcranial magnetic stimulation (TMS), and transcutaneous vagus nerve stimulation (tVNS). These methods are applied to modulate activity in key systems involved in regulating internal bodily signals and social coordination, to assess whether influencing these systems can enhance physiological attunement and interpersonal performance. The study further investigates whether neural and physiological synchrony arises during real-time dyadic interactions, and how this synchrony may be disrupted in clinical conditions such as Parkinson's Disease.
Research team and environment: This research project will be carried out at CoSAN lab (agliotilab.org), Department of Psychology, Sapienza University of Rome, Italy. The laboratory 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., philosophy of mind, 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 physiological signals processing and data analysis is considered a plus.

Special requirements, additional to "standard" ones:

The Phd Student must collaborate in the reporting activities as scheduled in the Funding Program and meet any further requirements foreseen in the framework of the Project "Starting Grant FIS-2"

Curriculum 2: Neuroscience and Humanities

Code 2.3

2.3 Project description:

Project title: A neuro-socio-cognitive framework to understand the role of threat processing in ideological extremism.

ERC Field: SH4_2 - Personality and social cognition; emotion SH4_4 - Neurocognitive psychology
SH4_6 - Learning, memory; cognition in ageing

Key words: EMOTION, IDEOLOGY, LEARNING, NEUROPHYSIOLOGY, PHYSIOLOGICAL PSYCHOLOGY, SOCIAL NEUROSCIENCE

Host Institution: University of Messina

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

Research topic description
Confronting ideological extremism has become a central objective of the European Commission—especially in recent years—as part of broader efforts to strengthen internal security, uphold democratic values, and prevent radicalization. However, the limited effectiveness of current approaches underscores the urgent need for a deeper, science-driven understanding of the mechanisms that fuel extremist political beliefs and behaviors.
This project proposes a novel neuro-socio-cognitive framework to investigate the role of threat processing in ideological extremism, offering new insights into how fear responses contribute to the development and maintenance of extremist ideologies.
The study focuses on the sensorimotor mapping of outgroup-related fear in politically and religious extreme individuals, comparing extremists to non-extremist control groups. To achieve this, the project will measure corticospinal tract excitability using transcranial magnetic stimulation (TMS) to elicit motor evoked potentials

(MEPs)—a neurophysiological marker indicating the motor system's readiness to act in response to perceived threats. Responses to threatening outgroup stimuli will be compared with reactions to neutral stimuli.
In parallel, psychophysiological, self-report measures including Implicit Association Tests (IATs) will be employed to assess psychological constructs related to group threat perception, ideological commitment, and intergroup bias.
By integrating neurophysiological, psychological, and social data, this research aims to provide a robust scientific account of the fear-extremism link in political and religious contexts—laying the groundwork for more effective, evidence-based interventions against radicalization and ideological polarization.

Research team and environment
This research project will be carried out in the COSPECS Department, University of Messina. The laboratory headed by Prof. Carmelo Mario Vicario 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 link between reward system, emotions and social behavior. The team consists of several researchers, post-doctoral fellows and PhD students with different backgrounds including philosophy, psychology, cognitive science, informatics and neuropsychology. Researchers have access to 2 labs of facilities equipped with Transcranial Magnetic Stimulation, virtual reality and devices to record psychophysiological/electrophysiological signals.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most used in basic cognitive-social neuroscience. Candidates with already completed lab training are preferentially considered for this position.

Curriculum 2: Neuroscience and Humanities

Code 2.4

Project title: Internal and external body states for self-awareness and social interactions

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 psychology

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

Host Institution: IRCSS Sacro Cuore Don Calabria - University of Verona

Reference person/supervisor: Valentina Moro valentina.moro@univr.it
Elena Rosato elena.rossato@sacrocuore.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, antropology, 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.

Special Requirements:
Executive position reserved to IRCSS Sacro Cuore employees

Curriculum 2: Neuroscience and Humanities

Code 2.5

Project title: Studying the effects of Virtual Reality training for the rehabilitation of social skills in neurodevelopmental disorders
ERC Field: SH4_1 Cognitive basis of human development and education, developmental disorders; comparative cognition; SH4_2 Personality and social cognition; emotion; SH4_4 Neuropsychology; SH4_5 Attention, perception, action, consciousness
Key words: neurodevelopmental disorders; neuromodulation; virtual reality; neurorehabilitation; neuropsychology; electroencephalography.
Host Institution: Scientific Institute, IRCCS E. Medea

Reference person/supervisor: Cosimo Urgesi cosimo.urgesi@unimercatorum.it
Alessandra Finisguerra alessandra.finisguerra@lanostrafamiglia.it

Research topic description
Recent studies suggested a close relationship between motor representations and high-level cognitive and social functions. Understanding the motor, sensory, emotional and cognitive states of people we interact with seems to be, at least partially, linked to embodiment of their mental states into our own internal states (embodied cognition). This association between motor, cognitive and social representations is relevant in developmental age, where more complex cognitive and social functions can emerge from basic sensory and motor functions. Predictive coding accounts of social cognition suggests that we anticipate others' actions based on context and past experiences. Various neurodevelopmental disorders present social deficits linked to dysfunctions in predictive mechanisms and basic cognitive skills. The present research aims to study the use of novel methodologies for boosting the effects of rehabilitation in neurodevelopmental disorders by using noninvasive brain stimulation techniques, particularly transcranial direct current stimulation (tDCS), transcranial alternating current stimulation (tACS) and transcutaneous vagal nerve stimulation (tVNS), combined with new technologies, such as Virtual or Augmented Reality, to promote neuroplasticity. It is hypothesized that training that promotes the creation of predictive models, integrating sensory information and expectations about daily

events, can enhance social skills. Specifically, near and far-transfer effects on social competencies assessed outside the virtual reality context with standardized neuropsychological tests and ad-hoc behavioral paradigms and electroencephalographic measures will be measured.

Research team and environment
The IRCCS Eugenio Medea is a scientific institute specialized in research, treatment and training in the field of neurological and neuropsychic pathologies in the developmental age. It has obtained the IRCCS recognition from the Ministry of Health in different regions. Through the network of rehabilitation centers of the Associazione La Nostra Famiglia, the IRCCS Eugenio Medea has access to the widest range of cases in Italy in the field of neurological and neuropsychological disabilities in the age of development. The research facilities are equipped with:
- Bioinformatics Laboratory, for genetic analysis for clinical and research purposes;
- Bioengineering laboratory, with virtual reality systems and movement analysis, for the development of new technologies applied to neurorehabilitation;
- Neuroimaging laboratory, with a 3T scanner in place and access to a 7T scanner, for the study of the anatomical and functional correlates of neurodevelopmental disorders and the effects of neurorehabilitation;
- EEG Lab (with EEG and eye-tracking system) for the early diagnosis of neurodevelopmental disorders and measurements of the outcome of rehabilitation programs;
- Laboratory of Neuromodulation, with transcranial magnetic stimulation systems, transcranial electrical stimulation and transcutaneous vagus nerve stimulation, for the facilitation of cerebral plasticity during neurorehabilitation.

Preferred Research Skills and Competences
The ideal candidate has previous experience and/or interests in neurorehabilitation, neuropsychology, electroencephalography and/or neuromodulation studies in developmental age. He/she has strong background in cognitive neuroscience, cognitive psychology, neuropsychology and aims to foster his/her knowledge in neuropsychology, neurorehabilitation, and neuromodulation of neurodevelopmental disorders.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.1

*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 3.2

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 3.3

Project Title: Innovative Pharmacological and Nutraceutical Strategies for Neuroprotection and Cognitive Health Support -

ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy; LS5_12 Psychiatric disorders
Key words: Cognition, Oxidative Stress, Neuroinflammation, Pharmacology
Host Institution: University of Camerino
Reference person/supervisor: Roberto Ciccocioppo roberto.ciccocioppo@unicam.it

Recent epidemiological projections suggest that by 2050 the global prevalence of dementia will triple, posing an unprecedented socio-medical challenge. In addition to Alzheimer, exposure to substances of abuse is increasingly recognized as a biologically driven disorder, characterized by molecular and synaptic dysfunctions that arise long before clinical symptoms appear. Among the earliest and most vulnerable targets of the disease are mitochondria, whose dysfunction is associated with impaired energy production, oxidative stress, and loss of neuronal plasticity.

Our laboratory is actively engaged in the development of innovative therapeutic strategies based on pharmacological agents and nutraceutical products aimed at preserving or restoring cognitive functions. These approaches seek to slow the progression of cognitive decline by promoting neuronal resilience through multifactorial interventions. Interest in naturally derived molecules, including dietary supplements and bioactive compounds, aligns with the growing demand for preventive, safe, and accessible solutions—particularly in an aging population.

The selected PhD candidate will join a multidisciplinary research environment, working with animal models of neurodegeneration and cognitive deficits applying state-of-the-art molecular and behavioral pharmacology techniques.

Research team and environment
The laboratories involved in the project offer a multidisciplinary environment to investigate complex questions in neuroscience. The main research focus of this team of researchers is on the study of the neurobiological basis of substance use disorder. Researchers have access to multiple laboratories, 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. 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 pharmacology, proteomics, behavioural testing, molecular biology, histology and data analysis. Candidates with training backgrounds in life sciences, behavioral pharmacology, pharmaceutical sciences, molecular genetics, are preferentially considered for this position.

Special Requirements:
Executive positions reserved to Neurastem employes or PhD higher education apprentices to be hired, according to laws and regulations in force into the matter (age requirements etc.)

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.4

Project title: Neurobiological, behavioral, and pharmacological basis of attention deficit hyperactivity disorder, substance abuse, 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, Impulsivity, Attention, Environment, Neurocircuitry, Pharmacology.
Host Institution: University of Camerino
Reference person/supervisor: Nazzareno Cannella **nazzareno.cannella@unicam.it**

Research topic description
Cannella's Lab focuses on the neurobiology and neuropharmacology of Attention Deficit Hyperactivity Disorder (ADHD) and Substance Use Disorder (SUD), two psychiatric conditions that represent a major global social and health burden. Both ADHD and SUD are associated with dysfunction in motivational, top-down control, and stress-related neurocircuitry. The development of these disorders is influenced by genetic predisposition and environmental insults—such as exposure to drugs, violence, and social stigmatization—experienced throughout life, from the fetal stage to adulthood. Additionally, gender differences contribute to distinct susceptibilities and clinical profiles for these conditions. These three factors—genetic, environmental, and gender—interact to increase an individual's risk of developing ADHD and SUD.

Our laboratory aims to investigate the neurobiological and neuropharmacological mechanisms through which these factors contribute to the onset of ADHD and SUD, with the ultimate goal of identifying novel molecular targets and therapeutic strategies. To achieve this, we use behavioral models of ADHD and SUD in combination with pharmacological and genetic manipulations, as well as in vivo optogenetic, chemogenetic, and neurophysiological techniques. We also employ viral-mediated upregulation and downregulation of specific receptors in targeted brain regions to explore the role of distinct neural circuits. Histological and biomolecular techniques are further used to support our investigations.

Research team and environment
This research project will be conducted at the School of Pharmacy, Center for Neuroscience, University of Camerino, Italy. The laboratory, led by Prof. Nazzareno Cannella, is an international research group integrated into the University's Center for Neuroscience (CNS). The CNS aims to foster a multidisciplinary, diverse, and collaborative environment where complex questions in neuroscience are addressed through the integration of multiple scholarly perspectives—an approach from which students benefit as they pursue high-quality scientific training.

The main research focus of the laboratory is to investigate the neurobiological underpinnings and brain functions involved in motivated behaviors and the psychopathology of substance use disorder and attention deficit hyperactivity disorder, with a particular emphasis on reward-seeking, motivation, and impulsivity. The lab's ultimate goal is to understand the neurobiological mechanisms underlying these maladaptive behaviors in order to facilitate the development of innovative treatments. In the field of psychopharmacology, the lab also explores precision medicine, particularly by studying endophenotypes related to treatment response.

The laboratory has access to a 1,500 m² animal facility equipped with operant self-administration chambers, Elevated Plus Maze, Porsolt swimming 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 it has full access to light, fluorescent, confocal, and scanning electron microscopes. Additionally, 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 in pharmacological, chemogenetic, optogenetic, and genetic engineering approaches. Applicants with academic backgrounds in life sciences, behavioral pharmacology, pharmaceutical sciences, molecular genetics, or medicine will be preferentially considered for this position

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.5

Project title: Translational strategies leveraging neurotechnology to address long-term motor and cognitive sequelae in post-critical illness across care settings.

ERC Field: LS5_5 Neural networks and plasticity; LS5_7 Sensory systems, sensation and perception, including pain; LS5_8 Neural basis of behavior (e.g. sleep, consciousness, addiction); LS5_9 Neural basis of cognition (e.g. learning, memory, attention, emotions, speech); LS5_11 Neurological and neurodegenerative disorders; LS5_12 Mental disorders; LS5_13 Nervous system injuries and trauma, stroke; LS5_16 Systems and computational neuroscience (e.g. modelling, simulation, brain oscillations, connectomics); LS5_18 Innovative methods and tools for neuroscience; SH4_4 Neurocognitive psychology; SH4_5 Attention, perception, action, consciousness; SH4_6 Learning, memory; cognition in ageing.
Key words: Cognition; Executive functions; Motor control; Sensorimotor integration; Cognitive training; Critical illness; Motor and cognitive telerehabilitation
Host Institution: University of Brescia

Reference persons/supervisors:
Debora Brignani debora.brignani@unibs.it
Luca Falciati luca.falciati@unibs.it

Research topic description
With the continuous advancement of clinical practices and therapeutic protocols, there has been a marked increase in the number of patients surviving critical illnesses. However, survival does not necessarily equate to full functional recovery: these patients often experience severe physical impairments and may also develop cognitive deficits of varying severity, which can emerge both during hospitalization and after discharge. This phenomenon manifests, for instance, in patients in the intensive care units and is referred to as post-intensive care syndrome. However, this condition may potentially occur in any patient suffering from critical illness. One of the exacerbating factors may be hospitalization under conditions of prolonged isolation, where restricted mobility and limited environmental interactions can further reduce sensory and cognitive stimulation, contributing to the deterioration of neuropsychological and motor functions. Critically ill patients may exhibit simultaneous impairments across physical, cognitive, and psychological domains with differing degrees of persistence and severity, highlighting the need for tailored intervention protocols. Modern neurotechnologies - defined as the set of tools and methodologies designed to record, modulate, and interpret central and peripheral nervous system activity through neural interfaces, advanced sensors, and neurophysiological data analysis algorithms - represent a promising avenue for translation into clinical applications. These technologies can be integrated into the development of innovative protocols for the assessment and rehabilitation of cognitive and motor functions in survivors of critical illness. In this population, the need for functional support - particularly to counteract neurocognitive and motor decline - is often underestimated in conventional therapeutic pathways, which tend to focus primarily on acute care management. Within this framework, telemedicine also emerges as a highly valuable tool, enabling remote monitoring and continuity of rehabilitative interventions, while reducing logistical barriers and facilitating timely, personalized care. The synergistic integration of neurotechnologies and telemedicine solutions thus holds significant potential to foster a more comprehensive, sustainable, and patient-centered rehabilitative approach. Our research group aims to contribute to this evolving field by exploring novel strategies grounded in objective neurophysiological and behavioral markers, with the overarching goal of developing advanced technological solutions for the (tele)assessment, (tele)monitoring, and (tele)enhancement of cognitive and motor functions. Specifically, we seek to integrate well-established neurophysiological techniques with cutting-edge systems for the analysis of cognitive and motor abilities. The project is structured around the main objective of developing and validating innovative, patient-centered (tele)rehabilitation protocols tailored to the complex needs of individuals recovering from critical illness. By leveraging the synergistic potential of neurotechnologies and telemedicine, our work aims to support the development of sustainable, effective, and personalized rehabilitation pathways that extend beyond the traditional clinical setting.

Research team and environment

The research project will be carried out in the Neurophysiology Laboratories (headed by Prof. Debora Brignani and Dr. Luca Falciati), at the Department of Clinical and Experimental Sciences of University of Brescia, and in collaboration with clinical units of the ASST Spedali Civili of Brescia. The research aims to develop innovative telehealth interventions in the cognitive-motor domain and telerehabilitation protocols for the recovery of critically ill patients. The Neurophysiology Laboratories are equipped with advanced systems for the acquisition of biosignals (e.g., EEG, eye tracking, EMG, pupillometry, motion capture, skin conductance, heart rate), as well as cutting-edge methods for cognitive, cerebral, and peripheral non-invasive stimulation (e.g., TMS, NMES, tES). To enhance the ecological validity of the research protocols developed in the Neurophysiology Laboratories, virtual reality techniques (immersive and augmented) are also employed. These techniques enable to conduct experiments in highly realistic contexts, while physiological parameters and signals are simultaneously recorded. The Neurophysiology Laboratories are part of a broader project (IN2DEPT Innovative and Integrative Department Platforms) that has seen the recognition of the Department of Clinical and Experimental Sciences as a Department of Excellence by the Italian Ministry of University and Research. Specifically, the Neurophysiology Laboratories are part of the Applied Neuroscience Platform intended to implement, within an interdisciplinary context, an innovative interface platform between basic research and clinical practice in the field of neuroscience. In collaboration with the Hospital Clinical Neuroscience Laboratory and the Territorial Neuroscience Network, the activities of the Neurophysiology Laboratories are focused on two primary objectives: 1) to determine physiological biomarkers suitable for (i) characterizing the clinical profile in terms of psychomotor functional deficits, (ii) monitoring the evolutionary trajectory of the treated clinical condition, and (iii) predicting the outcome of various therapeutic interventions; 2) to develop, validate, and test individually tailored rehabilitation systems and protocols (e.g., neuromotor rehabilitation, cognitive training, non-invasive brain stimulation, immersive/augmented virtual reality, potentially supported by functional electrical stimulation techniques, etc.) that will also be made available in telehealth modalities. The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including brain activity recording, brain stimulation, behavioral testing and data analysis.

Preferred Research Skills and Competences

• A background in cognitive neuroscience-related field;
• Experience in the administration of standardized neuropsychological assessments;
• Experience in clinical settings involving direct interaction with patients;
• Skills in administering behavioral protocols;
• Hands-on experience in acquisition of neurophysiological indexes (e.g., EEG, EMG, eye movements);
• Skills in programming experiments with standard experimental software (e.g. PsychoPy; Psychtoolbox; Presentation);
• Skills in one programming language (preferably MatLab) and analyses tools (e.g. R, Jamovi, SPSS);
• Skills for teamwork in a multidisciplinary research group;
• Good command of the English language (written and oral).

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.6

Project title: Multibrain Dynamics in Aberrant Emotion Discrimination.

ERC Field: LS5_1 Neural cell function, communication and signalling, neurotransmission in neuronal and/or glial cells
LS5_2 Systems neuroscience and computational neuroscience (e.g. neural networks, neural modelling) LS5_3 Neuronal development, plasticity and regeneration
LS5_5 Neural bases of cognitive processes (e.g. memory, learning, attention)
LS5_8 Psychiatric disorders (e.g. affective and anxiety disorders, autism, psychotic disorders)
Key words: Social Behavior, Neurocircuitry, Emotions, Optogenetics, in vivo imaging.
Host Institution: 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.

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 3.7

Project title: Studying the role of sleep loss in the development of neuropsychiatric disorders: a focus on adolescent brain connectivity and alcohol use
ERC Field: LS5_2 Glial cells and neuronal-glial communication; LS5_5 Neural networks and plasticity; LS5_8 Neural bases of behaviour; LS5_12 Mental disorders; LS5_15 Neuroimmunology, neuroinflammation;
Key words: sleep, synapses, microglia, neurocircuitry, electrophysiology, electron microscopy, calcium imaging, scRNA-seq

Host Institution: University of Camerino

Reference person/supervisor: Luisa de Vivo, Michele Bellesi luisa.devivo@unicam.it
michele.bellesi@unicam.it

Research topic description
The research project is funded by the Giovanni Armenise Harvard Foundation and seeks to understand the intricate relationship between chronic sleep restriction, alcohol consumption, and synaptic connectivity in the adolescent brain, particularly focusing on the medial prefrontal cortex and connected brain regions. Epidemiological evidence suggests a bidirectional link between sleep problems and alcohol use disorders (AUD), yet the underlying molecular mechanisms remain unclear. Utilizing a preclinical model, the project aims to elucidate the impact of adolescent sleep loss and alcohol drinking on synaptic connectivity, prefrontal cortex function, and behavior. Through advanced techniques such as in vivo calcium imaging, optogenetic modulation, 3D electron microscopy and single nuclei transcriptomics, the study will investigate the effects of CSR and alcohol consumption on mPFC connectivity and synaptic refinement. Additionally, the project aims to explore novel therapeutic strategies to reverse the morphological, functional, and behavioral alterations associated with adolescent sleep restriction and alcohol drinking. The research offers a unique opportunity for a PhD student to contribute to state of the art neuroscience research and advance our understanding of the neurobiological mechanisms underlying sleep loss and AUD.

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 to characterize 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 and key interests of the research group 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 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 neurophysiology, interest in learning microscopy techniques, basic knowledge of Python or Matlab, and a propensity to care for details are desirable.
The doctoral candidate will receive training in histology, in vivo and ex vivo imaging (light and electron microscopy), electrophysiology in vivo, behavioural testing, molecular biology, and data analysis. Pharmacological, chemogenetic and optogenetic approaches will be also experienced.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.8

Project title: Multimodal electrostimulation to improve walking and stability in people with lower limb paralysis.
ERC Field: **LS7_1** Medical engineering and technology, **LS7_9** Health services, healthcare research, **LS5_4** Sensory systems, **PE6_6** Human-computer interaction and interface
Key words: Reward and Motivation, Environment, Neurocircuitry, Pharmacology, Electrophysiology,
Host Institution: Scuola Superiore Sant'Anna
Reference person/supervisor: Solaiman Shokur **solaiman.shokur@santannapisa.it**

Research topic description
Multimodal electrostimulation to improve walking and stability in people with lower limb paralysis.
Spinal cord injuries and strokes often result in significantly reduced capacities for locomotion and standing stabilization. This reduction in mobility not only diminishes the quality of life for affected individuals but also leads to secondary complications such as impaired bladder and bowel functions, social stigma, and skin issues like pressure sores. The MINE Lab at Università San Raffaele in Milan, affiliated with the Scuola Superiore Sant'Anna in Pisa under the leadership of Prof. Silvestro Micera, has pioneered a novel technique involving epidural stimulation to facilitate stepping in individuals with paralysis. While this technique has demonstrated remarkable efficacy in nine participants with paralysis due to spinal cord injury, these individuals still face limitations in standing independently without the aid of a walker. Achieving independent standing, in addition to walking, would significantly enhance the ability to perform activities of daily living, such as cooking, thereby greatly improving the quality of life. To address the limitations in standing stabilization, we propose integrating surface functional electrical stimulation (FES) with the existing epidural stimulation technique. Specifically, the surface FES will target the ankle joint, which plays a crucial role in stabilization. By combining these two stimulation methods, we aim to provide a more comprehensive approach to improving both locomotion and standing capabilities in individuals with lower limb paralysis. This integrated approach holds promise for enhancing the overall efficacy of electrostimulation therapies, thereby offering a more holistic solution to mobility challenges faced by these individuals.

Research team and environment
This research project will be carried out at the Biorobotics Institute of Scuola Superiore Sant'Anna (SSSA), within the Sensorimotor Neurotechnology Lab (SNL), based at Ospedale San Raffaele in Milan, Italy—one of the largest and most prestigious private hospitals in the country. The lab is part of the broader MINE Lab, a joint research initiative co-led by Prof. Silvestro Micera and Prof. Pietro Mortini, dedicated to the development and clinical validation of neurotechnologies to restore motor and sensory functions in individuals with severe impairments such as spinal cord injury and limb amputation.
The SNL, headed by Prof. Solaiman Shokur, is a translational research group that focuses on human neurophysiology and neuroprosthetic applications. Its primary mission is to design, test, and implement neurotechnologies that can restore lost motor or sensory functions through close integration of neural engineering, robotics, and clinical neuroscience. Current research directions include the use of epidural spinal cord stimulation to facilitate locomotion in people with complete paralysis, as well as the development of sensory feedback systems to support balance and mobility.

Though still in its early phase, the SNL works in close collaboration with the larger MINE Lab team, which includes physiotherapists, neurosurgeons, senior neuroengineers, and PhD students, forming a truly interdisciplinary environment. The team has developed and clinically tested multiple solutions for spinal cord injury rehabilitation and is at the forefront of first-in-human studies involving epidural stimulation, robotic assistance, and real-time sensorimotor feedback.

Researchers have access to a unique clinical research environment within the hospital, including rehabilitation facilities, custom-built robotic walkers, motion tracking systems, and equipment for EEG and EMG acquisition. All research is conducted with human participants, with ongoing clinical protocols run in collaboration with medical staff at San Raffaele.

Preferred Research Skills and Competences

The doctoral candidate will receive training in translational neural engineering, electrical stimulation, gait analysis, and gait training. They will work in a highly multidisciplinary environment at the intersection of engineering and clinical practice.

Candidates with a background in robotics, electrical engineering, biomedical engineering, or neuroengineering will be considered for the position.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.9

Project title: Targeting potassium channels for personalized treatment of neurodevelopmental diseases
ERC Field: LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy
Key words: NEURODEVELOPMENTAL DISORDERS, EPILEPSY, PERSONALIZED TREATMENT
Host Institution: University of Naples Federico II
Reference person/supervisor: Maurizio Taglialatela **(**mtaglial@unina.it)

Research topic description
Personalized medicine involves the use of genetic information to design novel, individualized approaches in specific conditions lacking proper therapeutic approaches. Genetic epilepsies represent one of the most active field for personalized medicine. Over the years, we have established a multidisciplinary, collaborative team involving medicinal chemists, pharmacologist, geneticists and clinicians to advance personalized treatment opportunities for individuals affected by severe forms of genetic epilepsies, focusing on voltage- and non-voltage-gated potassium channels. In particular, our research has focused on optimizing available pharmacological tools to improve their risk/benefit ratio by advanced structure-activity studies (retigabine, quinidine, just to mention a few); on the other hand, we are beginning to exploit an agnostic approach of drug repurposing to identify potential opportunities within libraries of molecules in advanced clinical stage of development or already approved for other indications.
The candidate will learn and utilize a wide range of molecular, in vitro, ex-vivo and in-vivo techniques pertaining to the topic, ranging from transient or stable transfections, patch-clamp electrophysiology, molecular modeling, protein biochemistry, mutagenesis, generation, culturing and differentiation of neurons and other cell types from induced-pluripotent stem cells from patient tissues.

Research team and environment
This research project will be carried out mainly at the Department of Neuroscience of the School of Medicine , of the University of Naples Federico II. The laboratory led by Prof. Maurizio Taglialatela, via a solid translational approach, takes advantage of the evolution of molecular diagnostics in genetics to study the pathogenetic mechanisms responsible for rare human channelopathies.
Main recent contributions in this field have been:
1. The identification of the voltage sensor as a “hot-spot” for KCNQ2-related diseases. This work has provided a rigorous framework for understanding disease molecular pathogenesis, revealing distinct phenotypes associated to loss-of-function (LoF) and gain-of-function (GoF) variants (*Castaldo et al. Benign familial neonatal convulsions caused by altered gating of KCNQ2/KCNQ3 potassium channels. J Neurosci. 2002 Jan 15;22(2):RC199; Nappi M et al. Constitutive opening of the Kv7.2 pore activation gate causes KCNQ2-developmental encephalopathy. Proc Natl Acad Sci U S A. 2024 Dec 3;121(49):e2412388121*);
2. The description of some of the correlations between genotypes and in-vitro phenotypes, highlighting a relevant prognostic role of mutant ion channel functional assessment (*Miceli et al. Genotype-phenotype correlations in neonatal epilepsies caused by mutations in the voltage sensor of K(v)7.2 potassium channel subunits. Proc Natl Acad Sci U S A. 2013 Mar 12;110(11):4386-91; Miceli et al. KCNQ2 R144 variants cause neurodevelopmental disability with language impairment and autistic features without neonatal seizures through a gain-of-function mechanism. EBioMedicine. 2022 Jul;81:104130*);
3. The development of pharmacological strategies used to overcome disease-causing functional derangements in KCNQ2/3-related disorders, using both repurposed compounds and newly synthesized analogues of available drugs (*Ostacolo et al. Synthesis and Pharmacological Characterization of Conformationally Restricted Retigabine Analogues as Novel Neuronal Kv7 Channel Activators. J Med Chem. 2020 Jan 9;63(1):163-185.; Musella et al. Beyond Retigabine: Design, Synthesis, and Pharmacological Characterization of a Potent and Chemically Stable Neuronal Kv7 Channel Activator with Anticonvulsant Activity. J Med Chem. 2022 Aug 25;65(16):11340-11364.*).
Similar approaches are also being pursued for developmental encephalopathies caused by variants in other voltage-gated potassium channel genes such as KCNT1 (*Iraci et al. In Silico Assisted Identification, Synthesis, and In Vitro Pharmacological Characterization of Potent and Selective Blockers of the Epilepsy-Associated KCNT1 Channel. J Med Chem. 2024 Jun 13;67(11):9124-9149; Trivisano et al. Fluoxetine Treatment in Epilepsy of Infancy with Migrating Focal Seizures Due to KCNT1 Variants: An Open Label Study. Ann Neurol. 2025 Feb 21. doi: 10.1002/ana.27213. Epub ahead of print. PMID: 39981956.*), KCNT2 (*Ambrosino et al. De*

novo gain-of-function variants in KCNT2 as a novel cause of developmental and epileptic encephalopathy. Ann Neurol. 2018 Jun;83(6):1198-1204. Cioclu et al. KCNT2-Related Disorders: Phenotypes, Functional, and Pharmacological Properties. Ann Neurol. 2023 Aug;94(2):332-349), KCNC1 (*Ambrosino et al. A novel KCNC1 gain-of-function variant causing developmental and epileptic encephalopathy: "Precision medicine" approach with fluoxetine. Epilepsia. 2023 Jul;64(7):e148-e155*.), and, more recently, KCNA3 (*Soldovieri MV et al. De novo variants in KCNA3 cause developmental and epileptic encephalopathy. Ann Neurol. 2024 Feb;95(2):365-376. doi: 10.1002/ana.26826. Epub 2023 Dec 28. PMID: 37964487*.).

The results achieved thus far have had a direct impact on patients and their families, since they helped to define the natural history of these diseases, reveal genotype-phenotype correlations, and improve patient stratification. My research hopes to lead to clinical trials based on the underlying molecular etiology, thus accelerating the identification of new therapies for these severe neurodevelopmental disorders (PMID: 37366158).

Preferred Research Skills and Competences

The doctoral candidate will receive training in the techniques most commonly used in basic neuroscience, including in vitro and in vivo imaging, electrophysiology, proteomics, behavioral testing, molecular biology, histology and data analysis. Candidates with training backgrounds in life sciences, molecular pharmacology, electrophysiology, pharmaceutical sciences, molecular genetics, 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.

Special Requirements:

Executive positions reserved to Biotecnica employes or PhD higher education apprentices to be hired, according to laws and regulations in force into the matter (age requirements etc.)

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.11

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

Project title: Sex-differences in the neurobiology of memory decline and treatments.

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

Key words: Sex-difference, Memory, Dementia, Neurocircuitry, Pharmacology, Electrophysiology,

Host Institution: Institute of Biochemistry and cell Biology (IBBC)- CNR

Reference person/supervisor: Elvira De Loenibus elvira.deleonibus@cnr.it

Research topic description

Memory decline is a core feature of aging and neurodegenerative disorders, yet its progression and underlying neurobiology differ significantly between sexes. Despite growing recognition of these disparities, most preclinical and clinical studies remain male-biased, limiting the development of effective, sex-specific interventions. This project aims to uncover the molecular and circuit-level mechanisms driving sex differences in memory decline, with a focus on dynamic interaction between cortico-subcortical systems known to support memory and executive functions. We combine behavioral, cellular, and imaging approaches in animal models to track memory trajectories across the lifespan, and to identify sex-specific vulnerabilities in neurotransmitter systems, neuroinflammation, and synaptic plasticity. In parallel, we test candidate pharmacological and circuit-based treatments—including dopaminergic modulators and autophagy enhancers—for their differential efficacy in males and females in genetic animal models of dementia. By integrating sex as a biological variable, this research will provide critical insight into personalized approaches for preventing or reversing cognitive decline in aging and neurodegenerative diseases.

Research team and environment

The project is led by a multidisciplinary team with strong expertise in memory circuits, sex differences, and neurodegenerative diseases. The PI, Elvira De Leonibus, has over 20 years of experience in identifying sex-specific mechanisms of cognitive decline and developing therapeutic strategies in animal models of Parkinson's, Alzheimer's, and lysosomal storage disorders. The team has demonstrated sex-dependent circuit recruitment under high memory load and validated pharmacological and circuit-based interventions to enhance memory.

Research will employ established genetic models of Alzheimer's disease (APP/PS1) and MPS IIIA, both showing sex-specific memory decline. The project is based at IBBC-CNR in the International Campus of Monterotondo (Rome) and in collaboration with TIGEM, in Puzzuoli. IBBC is equipped with advanced platforms for behavioral phenotyping, in vivo imaging, molecular analysis, electrophysiology, and genetic manipulation. This environment supports integration of basic and translational neuroscience and provides a robust framework to explore sex-informed therapeutic strategies for memory decline.

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 neurobiology are preferentially considered for this position

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.12

Project title: Multiple Sclerosis: From Animal Models to Human Studies
ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS5_11 Neurological disorders LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy
Key words: Multiple Sclerosis, Behaviour, Neurocircuitry, Pharmacology, cells culture,
Host Institution: University of Cagliari

Reference person/supervisor: Paola Fadda **paola.fadda@unica.it**

Research topic description
Multiple sclerosis (MS) is a chronic neurodegenerative disease of the central nervous system (CNS), characterized by an autoimmune process that causes destruction of myelin and lipid sheath that surrounds nerve fibers. Progressive loss of myelin impairs neuronal communication, leading to motor, sensory, and cognitive dysfunction since MS is cause of chronic neurological disability in patients.
In addition, MS is an inflammatory pathology characterized by chronic activation and central nervous system (CNS) infiltration of peripheral immune cells, glial reactivity, axonal and neuronal damage, and blood brain barriers' (BBB) dysfunctions.
Epidemiological studies suggest that individuals with a genetic predisposition have an increased risk of developing the disease. MS presents one of the highest prevalence in Sardinia because of the particular genetic background and is one of the leading causes of permanent disability in young adults.
Even though the etiological causes are unknown, MS is considered a multifactorial disease determined by the interaction between genetic and environmental factors.
Pathological signs of MS are demyelinating plaques distributed throughout the brain and spinal cord, mainly in the white matter and, in some cases, also in the gray matter. These lesions are characterized by an inflammatory infiltrate composed of T lymphocytes, B lymphocytes, macrophages and microglia, which attack myelin and oligodendrocytes.
Especially at the beginning, MS is characterized by acute phases followed by periods of well-being with regression of the clinical signs in which the patient may no longer experience any symptoms.
With progression of the disease, however, the lesions tend to become chronic and are associated with loss of nerve cells and, in many patients develops a progressive form of MS that can lead to persistent and increasing disability over time.
MS is a chronic disease: although there is currently no definitive cure, numerous therapies (disease-modifying drugs, DMD) are available that can modify its course and slow its progression. Once the diagnosis of MS has been made with certainty, it is essential to start early treatment drugs which, with different mechanisms of action, are able to: suppress inflammation, prevent relapses and delay the progression of multiple sclerosis.
For these reasons, there is a critical necessitate for the development of new treatments that decrease the undesired adverse effects and contribute to the return to a best homeostasis.
Our laboratory aims to study the pathology, mechanisms that trigger and sustain it and its progression, with the final goal of identify new molecular targets and therapies for the treatment of MS. To exploit these projects, different animal models of MS (i.e cuprizone-based model of CNS demyelination, modeling prodromic and late demyelination phases and the experimental autoimmune encephalomyelitis (EAE) model induced by different myelin-derived proteins or peptide). These models are excellent tools for investigation of therapeutic efficacy and mechanism of action of novel therapies. On the in vivo animal model of MS in addition to the classic behavioural evaluations, immunohistochemical, molecular and biochemical studies or cells analysis will be carried out. The use of a transgenic model on mice will allow us to evaluate the neurocircuits and neurotransmitter of specific brain areas to determine their role in vulnerability to the pathology. The studies will be conducted on rats and mice of both sexes allowing us to approaches a sex difference evaluation.

Research team and environment
This research project will be carried out in the Department of Biomedical Science, University of Cagliari, Italy. The laboratory headed by Prof. Paola Fadda 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 neuro and psychopathology. The majority of this work is directed at the understanding the neurological mechanisms responsible for several pathologies and at identifying innovative pharmacological targets to aid the development of new more effective treatments. The Research team consists of researchers, residency and PhD students with different backgrounds including biology and pharmacology. The research team have access to an animal facility equipped with

several mazes (i.e EPM equipments, Porsolt swimming tubes, open field arenas for social interaction, Anymaze system for behavioral monitoring, etc).

The team of Prof. Paola Fadda can access to the Center For Research University Service (CeSAR) that is structured in high-tech interdisciplinary laboratories equipped with cutting-edge equipment and top-level scientific skills, capable of developing both fundamental and applied research. The Center is a non-profit organization and, in addition to research services, provides consultancy to researchers at the University of Cagliari for the performance of their institutional activities and to public and private bodies operating in the regional, national and international territory.

Preferred Research Skills and Competences
The doctoral candidate will receive training in the techniques most used in basic neuroscience, behavioural testing, molecular biology, studies on cells culture, Elisa analysis and data analysis. Candidates with training backgrounds in life sciences, behavioral pharmacology, molecular genetics, are preferentially considered for this position.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.13

Project title: Decipher the neural basis of impaired learning and memory in vascular cognitive impairment through a mouse model of hypertension induced cognitive impairment

ERC Field: LS5_8 Neural bases of behaviour; LS5_15 Neuroimmunology, neuroinflammation;

Key words: Cognitive impairment, Mouse models, Behavioural Analysis, Vascular Dementia, Hypertension

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

Reference person/supervisor: Daniela Carnevale Daniela.carnevale@uniroma1.it

Project decsription: Our aim is to characterize by advanced genetic technologies in mouse models the neural basis underlying the cognitive deficit induced by vascular dementia. In a mouse model of cerebral hypertension obtained by Transverse Aortic Ligation we have demonstrated that the microvascular bed suffers serious injury, with a rarefaction of capillaries and loss of BBB integrity. Our aim is to leverage a mouse model in which is possible to in vivo tag activated neurons by Tamoxifen administration (fosTRAP2 model). Leveraging TAC model on fosTRAP2 mice we will be able to identify the different neural activation during different cognitive tests (i.e. Morris Water Maze, Open Field test, Novel Object Recognition). Our aim is to identify the impact that cerebrovascular tree rarefaction has on the patterns of neural activation. Furthermore, our previous experiments pointed out a pivotal role of inflammation in establishing the cognitive impairment. In fosTRAP2 mice we will leverage spatial proteomics approaches to identify whether the different pattern of neuronal activity between TAC mice and relative controls is paired with a different pattern of immunoinflammatory activity and in a different microvascular structure in the same cerebral regions. The candidate role will be to establish the fosTRAP2 model for cognitive test activity trapping, manage the mouse colony, coordinate the overall experiments, collect and analyze the data of behaviour 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 in the joint research platform shared with IRCCS Neuromed. The laboratory headed by Prof. Carnevale is an integrated lab spanning through basic to translational science, with the overall aim of disentangling the relationship between the heart and the 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 experiences in experimental models of hypertension, mouse colony management, previous experience in in-vivo research and mouse handling.

Curriculum 3: Preclinical, Clinical and Translational Neuroscience

Code 3.14

N. 1 Scholarship funded by the Marche Region under Innovative PhD research scholarships with an industrial characterization for the academic year 2025/2026 - PR Marche FSE+ 2021-2027 Asse 4 OS 4a DGR N. 532 del 11/04/2025

Project Title: Next-generation nutraceuticals for supporting brain health.
ERC Field: LS5_3 Neurochemistry and neuropharmacology; LS7_3 Pharmacology, pharmacogenomics, drug discovery and design, drug therapy; LS5_12 Psychiatric disorders
Key words: Cognition, Oxidative Stress, Neuroinflammation, Pharmacology,
Host Institution: University of Camerino
Reference person/supervisor: Roberto Ciccocioppo roberto.ciccocioppo@unicam.it

Epidemiological projections indicate that the incidence of neurodegenerative disorders is progressively increasing. In addition to Alzheimer's disease, exposure to substances of abuse is now also recognized as a biologically driven pathological condition, characterized by molecular and synaptic dysfunctions that emerge well before the onset of clinical symptoms. Among the earliest and most vulnerable cellular targets are mitochondria, whose dysfunction compromises energy production, promotes oxidative stress, and reduces neuronal plasticity.
In this context, our laboratory is actively engaged in the development of innovative therapeutic strategies, based on both pharmacological agents and nutraceutical products, with the aim of preserving or restoring cognitive functions. These approaches, inherently multifactorial, seek to slow cognitive decline by promoting neuronal resilience. The growing interest in naturally derived molecules, including dietary supplements and bioactive compounds, reflects an increasing demand for preventive, safe, and easily accessible solutions—particularly in an aging population.
The selected PhD candidate will join a multidisciplinary research environment, working with animal models of neurodegeneration and cognitive impairment, and employing advanced techniques in molecular and behavioral pharmacology.

Research team and environment
The laboratories involved in the project offer a multidisciplinary environment to investigate complex questions in neuroscience. The main research focus of this team of researchers is on the study of the neurobiological basis of substance use disorder. Researchers have access to multiple laboratories, 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. 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 pharmacology, proteomics, behavioural testing, molecular biology, histology and data analysis. Candidates with training backgrounds in life sciences, behavioral pharmacology, pharmaceutical sciences, molecular genetics, are preferentially considered for this position.

Special requirements, additional to "standard" ones for Scholarship funded by the Marche Region :

***Scholarships reserved for graduates residing or domiciled in the Marche region, unemployed/not working, in accordance with current regulations, who have not yet reached 36 years of age at the time of application The requirements above mentioned must be met by the candidates at the time of submission of the application for participation in this call for applications.

-Mandatory Period of research mobility abroad: at least 6 months

-Further mandatory period of research and training mobility for the scope of the research topic (in Italy): period to be defined at the premises of the involved companies and Clusters of Marche Region

Further aspects related to this topic must comply with the project the position is based on.

Curriculum 4: Computational and System Neuroscience

Code 4.1

Project title: Neurobehavioral fingerprinting of schizophrenia via self-supervised learning in deep neural networks
ERC Field: SH4_5 Attention, perception, action, consciousness; LS5_2 Systems neuroscience and computational neuroscience (e.g. neural networks, neural modelling); LS5_5 Neural bases of cognitive processes (e.g. memory, learning, attention)
Key words: motor control, movement analysis, MoCap, EEG, machine learning, deep neural networks
Host Institution: University of Ferrara
Reference person/supervisor: Alessandro D'Ausilio alessandro.dausilio@unife.it

Research topic description
The study of how the activity of the nervous system controls human movements has been a central goal of neuroscience since its historical origins (Fritsch & Hitzig, 1870). In recent decades, modelling the neural dynamics underlying movement coordination has become pivotal in the development of brain-machine interfaces—an application that has attracted significant interest from major technology companies such as Google, Facebook, and Neuralink.
Due to the inherent complexity of the issue, research has often adopted a reductionist approach, particularly in behavioural analyses. Typically, behaviour has been reduced to simple, short movements repeated numerous times. However, a growing body of evidence suggests that this reductionist methodology may introduce significant limitations, and even artefacts, as the nervous system does not govern movement in a piecemeal fashion (Bernstein, 1967).
Crucially, the historical reliance on simplified behaviours was largely a result of limited statistical methodologies. With the advent of advanced artificial intelligence, particularly deep learning, novel techniques have emerged that can bridge this gap. Recent developments now enable the extraction of latent representations that unify neural and behavioural data—so-called joint neural and behavioural latent embeddings (Schneider et al., Nature, 2023; Safaie et al., Nature, 2023). A key advantage of these methods is their flexibility with respect to data dimensionality, allowing more ecologically valid behavioural paradigms to be analysed in conjunction with complex neural signals.
In this PhD project, the candidate will receive training in these cutting-edge computational methods and apply them to multimodal datasets—including electroencephalographic (EEG) and motion capture recordings—collected from healthy individuals during solo and dyadic motor interaction tasks. These paradigms are designed to probe how social and motor interactions shape neural representations across individuals.
Importantly, this framework opens a novel path toward psychiatric applications, particularly in the domain of precision diagnostics for schizophrenia. Schizophrenia is increasingly understood as a disorder not only of cognition, but also of sensorimotor integration and interpersonal synchrony. By characterising shared and individual latent neuro-behavioural representations, this project aims to establish foundational biomarkers for socio-motor dysfunctions observed in schizophrenia. Ultimately, the integration of AI-driven joint embeddings with ecological motor paradigms may offer a new avenue for early and personalised diagnostic strategies in psychiatry.

Research team and environment
The PhD student will have access to state-of-the-art laboratories for human movement and non-invasive electrophysiological recordings and will be part of a group already working on these AI technologies (2 post-docs and 2 more PhD students). The candidate will also benefit from participating in the research and training activities promoted by the Translational Neurophysiology Centre of the Italian Institute of Technology, hosted by the University of Ferrara, and by the network of experts participating in the EU PRIMI project.

Preferred Research Skills and Competences
The ideal candidate has a degree in engineering, computer science, physics or neuroscience and has a particular interest in working with non-invasive human neurophysiological signals and motion capture data. Advanced programming skills and a general knowledge of common machine learning techniques are required.

Curriculum 4: Computational and System Neuroscience

Code 4.2

Scholarship Funded under the project Starting Grant FIS-2023-00724 - Project Code (CUP): E53C24003680001

Project title: Structural and biological properties of α-synuclein aggregates in Parkinson's disease
ERC Field: LS1_1 Macromolecular complexes including interactions involving nucleic acids, proteins, lipids and Carbohydrates. LS1_9 Structural biology and its methodologies (e.g. crystallography, cryo-EM, NMR and new technologies). LS5_7 Neurological disorders (e.g. neurodegenerative diseases, seizures)
Key words: Parkinson's Diseases, Toxicity of transient amyloid aggregates, α-synuclein, Prion, Biophysics.
Host Institution: University of Napoli Federico II

Reference person/supervisor: Giuliana Fusco **giuliana.fusco3@unina.it**

Research topic description
The aberrant aggregation of α-synuclein (αS) into amyloid fibrils is associated with a range of highly debilitating neurodegenerative conditions including Parkinson's disease (PD). Although the properties of mature αS amyloid structures are currently understood, the nature of transient protofilaments and fibrils that appear during αS aggregation remains elusive. These molecular species are extremely relevant to delineate the underlying mechanisms of PD and are also considered the main targets for therapeutic design. In fact, it is now well established that transient αS aggregates are those responsible for toxicity and neuronal death in PD. It is therefore critical to achieve a structural description of these transient aggregates forming under pathological conditions. Using a combination of cellular and molecular biophysics, this project aims at an ambitious characterization of intermediate αS aggregates that have strong cytotoxic activity when incubated with neuronal cells and include αS. Our ultimate goal is to delineate for these species the structure-toxicity relationship from in vitro to in vivo. Their interdisciplinary characterisation will enable to clarify the role of critical structural elements endowing intermediate αS aggregates with the ability to induce cytotoxicity to achieve a new paradigm in understanding the pathophysiology of PD.

Research team and environment
The research team is based in the Department of Pharmacy of the University of Naples Federico II, Italy. The PI, Giuliana Fusco, returned from Cambridge after several years of research via the Montalcini programme to attract international scientists. The lab studies the molecular mechanisms involving in function and pathology αS. Over the years we have elucidated how different species of αS bind with biological membranes, including the elucidation of its role in the clustering of synaptic vesicles (Nat Commun 2016, 7:12563 and their stabilisation onto the pre-synaptic membrane (Nat Commun 2021, 12:927). In the pathological context, we have characterized the structural properties of αS toxic oligomers (Science 2017, 358:1440-3) and the role of liquid-liquid phase separations in promoting its aggregation (JACS 2024, 146, 15, 10537-49). The team consists of several post-doctoral fellows and PhD students with backgrounds spanning chemistry, biology, pharmaceutical sciences and biotechnology. Researchers have access to state of the art infrastructure for molecular and structural biology in the Department and, through various associated institutes in Naples, to other high-end facilities, including light and electron microscopy, cellular culture and C.elegans.

Preferred Research Skills and Competences
The doctoral candidate will receive training in cutting-edge techniques in biophysics, including molecular structural biology, NMR and Cryo-EM, as well as cellular biophysics and data analysis. Candidates with training backgrounds in molecular biology, biophysics, biological chemistry, biotechnologies are preferentially considered for this position.

Curriculum 4: Computational and System Neuroscience

Code 4.3

Scholarship funded under the following project: “NeuroRobCoRe - Interfacce neurorobotiche ibride per il controllo e il recupero della funzionalità motoria e verbale” ammesso al finanziamento (Provvedimento CNR-STIIMA prot. n. 196844 del 03/06/2025) nell’ambito del Bando a cascata per attività di ricerca industriale e sviluppo sperimentale dell’iniziativa PNC0000007 “Fit4MedRob- Fit for Medical Robotics”, spoke 2, Piano Nazionale Complementare (PNC) (Decreto Direttoriale n. 931 del 6/6/2022) – finanziato con Decreto Direttoriale del 09/12/2022, prot. n. 0001984, CUP B53C2200695000

Project title: Multimodal analysis of the sensorimotor functions using machine learning techniques

ERC Field: LS5_16 Systems and computational neuroscience (e.g. modelling, simulation, brain oscillations, connectomics)

Key words: posterior parietal cortex, kinematics, machine learning, virtual reality, neurophysiology

Host Institution: University of Bologna

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

Research topic description

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

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, kinematics, behavioural recordings, machine learning, virtual reality, data analysis. Candidates with training backgrounds in life sciences, behavioral analysis, electrophysiology, coding experience, ML techniques, Virtual reality experience, are preferentially considered for this position.

Curriculum 4: Computational and System Neuroscience

Code 4.4

Scholarship Funded under the project ERC-2022-SYG Grant number 101071900 neurological mechanisms of injury and sleep-like cellular dynamics (NEMESIS) CUP C93C23004980007

Project title: Investigating sleep-like dynamics and cortical connectivity in focal brain injury through invasive recordings in humans.
ERC Field: LS5_2 Systems neuroscience and computational neuroscience
Key words: intracranial recording, intracranial stimulation, sleep, brain lesion, sensory stimulation
Host Institution: University of Milan (UNIMI)

Reference person/supervisor: Andrea Pigorini **email: andrea.pigorini@unimi.it**
Marcello Massimini **email: marcello.massimini@unimi.it**

Research topic description
In the context of the project NEMESIS (NEurological MEchanisms of Injury and Sleep-like cellular dynamics), funded by European Research Council (ERC) with a synergy grant, UNIMI will create datasets, analysis pipelines and experimental set-ups to explore human cortical circuits from a causal perspective, whereby cortical perturbations and recordings are performed both intracranially and extracranially. Specifically, UNIMI will collect a large curated and standardized dataset comprising Stereo-electroencephalographic (SEEG) intracranial recordings in humans performed before and after localized cortical lesions (delivered for epilepsy treatment) both at rest and during intracerebral stimulation, which constitute the gold-standard for estimating effective connectivity. All this data will be used to study the mechanistic underpinning of loss and recovery of brain functions in physiological conditions (wake and sleep) as well as in stroke. The PhD student will be involved mainly in data collection, data preprocessing, data storage, analysis, and code writing.

Research team and environment
The team in which the PhD will work is a large lab of around 15-20 PhD students (5 on this project) and post-docs researchers in the fields of neurophysiology, bioengineering and system neuroscience with the supervision of experimental neurologists, bioengineers and neuroscientists.
The research will be developed in University of Milan and partner institutions (Niguarda Hospital, IRCCS Fondazione Don Gnocchi, IRCCS Fondazione Maugeri and IN-CNR, University of Padova, Universitat Pompeu Fabra, IDIBAPS Barcellona), and will foresee international mobility (active collaborations with Harvard University, Stanford University, Universitat Pompeu Fabra, IDIBAPS Barcellona).

Preferred Research Skills and Competences
The ideal candidate has experience in intracerebral and/or scalp EEG data collection and brain stimulation. The ideal candidate has a background in neurophysiology / biomedical engineering / bioinformatics and should be willing to work not only in a laboratory but also in clinical environments such as stroke unit and epilepsy surgery unit, interacting with clinicians, physicians and patients. The ideal candidate must be able to carry out

his/her work in a diligent, independent, and highly collaborative manner. The ideal candidate has advanced experience in coding (mainly Python).

Curriculum 4: Computational and System Neuroscience

Code 4.5

Scholarship Funded under the project ERC-2022-SYG Grant number 101071900 neurological mechanisms of injury and sleep-like cellular dynamics (NEMESIS) CUP C93C23004980007

Project title: Investigating sleep-like dynamics and cortical connectivity in focal brain injury through non-invasive recordings in humans.
ERC Field: LS5_2 Systems neuroscience and computational neuroscience
Key words: TMS, EEG, sleep, brain lesion, sensory stimulation
Host Institution: University of Milan (UNIMI)
Reference person/supervisor: Andrea Pigorini **email: andrea.pigorini@unimi.it**
Marcello Massimini **email: marcello.massimini@unimi.it**

Research topic description
In the context of the project NEMESIS (NEurological MEchanisms of Injury and Sleep-like cellular dynamics), funded by European Research Council (ERC) with a synergy grant, UNIMI will create datasets, analysis pipelines and experimental set-ups to explore human cortical circuits from a causal perspective, whereby cortical perturbations and recordings are performed both intracranially and extracranially. Specifically, UNIMI will collect a large curated and standardized dataset comprising data collected during transcranial magnetic stimulation combined with electroencephalography (TMS-EEG) in healthy subjects as well as in pathological stroke patients. This data will be used to study the mechanistic underpinning of loss and recovery of brain functions in physiological conditions (wake and sleep) as well as in stroke. The PhD student will be involved mainly in data collection, data preprocessing, data storage, analysis, and code writing.

Research team and environment
The team in which the PhD will work is a large lab of around 15-20 PhD students (5 on this project) and post-docs researchers in the fields of neurophysiology, bioengineering and system neuroscience with the supervision of experimental neurologists, bioengineers and neuroscientists.
The research will be developed in University of Milan and partner institutions (Niguarda Hospital, IRCCS Fondazione Don Gnocchi, IRCCS Fondazione Maugeri and IN-CNR, University of Padova, Universitat Pompeu Fabra, IDIBAPS Barcellona), and will foresee international mobility (active collaborations with Harvard University, Stanford University, Universitat Pompeu Fabra, IDIBAPS Barcellona).

Preferred Research Skills and Competences
The ideal candidate has experience in intracerebral and/or scalp EEG data collection and brain stimulation. The ideal candidate has a background in neurophysiology / biomedical engineering / bioinformatics and should be willing to work not only in a laboratory but also in clinical environments such as stroke unit and epilepsy surgery unit, interacting with clinicians, physicians and patients. The ideal candidate must be able to carry out his/her work in a diligent, independent, and highly collaborative manner. The ideal candidate must have advanced experience in coding (mainly Python).

Curriculum 4: Computational and System Neuroscience

Code 4.6

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.

Special Requirements:
Executive positions reserved to Am-microsystem employes or PhD higher education apprentices to be hired, according to laws and regulations in force into the matter (age requirements etc.)

Curriculum 4: Computational and System Neuroscience

Code 4.7

*the 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 4.8

Project title: Advanced neuroimaging approaches to characterize the cerebral glymphatic system injury in cardiovascular diseases and vascular dementia

ERC Field: LS5_17: Imaging in Neuroscience

Key words: Cognitive impairment, Glymphatic system, Neuroimaging, Cardiovascular diseases, Dementia

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

Reference person/supervisor: Daniela Carnevale Daniela.carnevale@uniroma1.it

Project decsription: Our aim is to characterize by advanced radiomic features obtained on neuroimaging data different aspects of the glymphatic system. In particular, we will combine imaging features of structural determinants of the glymphatic system, like the choroid plexus volume; microstructural determinants of the glymphatic system as the diffusion along the perivascular spaces (DTI-ALPS); functional determinants of the glymphatic system as the coupling between the global BOLD signal and the CSF influx in the brain (gBOLD-CSF coupling). We aim to leverage these novel features of cerebral glymphatic injury to investigate the effects that cardiovascular risk factors as hypertension exert on the brain, and whether the determinants of glymphatic injury can improve the risk estimate for developing cognitive impairment and vascular dementia. The candidate responsibility will be to elaborate algorithms for radiomic features calculation, data analysis and data management on an existent neuroimaging dataset and coordinate the acquisition for novel dataset on cohorts with ongoing recruitment.

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 in the joint research platform shared with IRCCS Neuromed. The laboratory headed by Prof. Carnevale is an integrated lab spanning through basic to translational science, with the overall aim of disentangling the relationship between the heart and the 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 experiences in Data Science and scientific data management, coupled with programming skills in Matlab and Python. Preferential consideration will be given to users with practical knowledge in the most common neuroimaging software suites (FSL, Freesurfer).