LM- 51 Cognitive neuroscience

The master course in Cognitive Neuroscience is particularly suited to students interested in understanding the neural correlates of the cognitive processes as well as the relationship between the development of the mind and the brain. The aim is to train psychologists with a 3 years bachelor with the perspectives from cognitive neuroscience, cognitive psychology and developmental neuroscience as well as hands-on training in imaging methods. The course trains students to carry out research in cognitive neuroscience offering high-level teaching, large space to practical supervised activity in didactic and professional labs and the possibility to carry out an experimental thesis at the research labs of the Department of Psychology of Rome and in partner institutions.

In particular, the master course offers competences for the evaluation of cognitive abilities in adutlhood and during development and the early individuation of cognitive disturbances due to alterations of neurodevelopment identifying the rehabilitative actions based on current up-to-date knowledge. It presents an intervention perspective also open to collaborations on issues relevant for developing countries. The master aims to develop advanced theoretical and applied know-how on research methods in Neuropsychology, Cognitive Psychology and Psychobiology. At the end of this master students will receive a professional title of Psychologist (after completing a one year training and the State exam).

The master features twelve courses that offer a high level of specific preparation (90 CFU). Courses are tought in English for both Italian and foreign students. Students have a waiver for the B2/C1 level in Italian, otherwise required by La Sapienza for Masters in Italian. In this case students will be required to have a B2 level in English.

Master outline:

Course	Lang.	Teacher	SDD	CFU	Year	Semester
Experimental methods in Social Neuroscience	Engl.	Matteo Candidi	M-PSI-02	9 (lab 3)	1	1
Affective neuroscience across the lifespan	Engl.	Anna Pecchinenda	M-PSI-01	6	1	1
Perceptual and cognitive processing	Engl.	Marialuisa Martelli	M-PSI-01	9 (lab 3)	1	1
Cognitive Neuroimaging	Engl.	Gaspare Galati	M-PSI-02	9 (lab 3)	1	2
Individual differences in personality and temperament	Engl.	Laura Di Giunta	M-PSI-01	9 (lab 3)	1	2
Data analysis and statistical testing in cognitive neuroscience	Engl.	Grazia Spitoni	M-PSI-03	6	1	2
Engineering Psychology and Human Performance	Engl.	Francesco Di Nocera	M-PSI-06	6	1	2
Learning disabilities	Engl.	Pierluigi Zoccolotti	M-PSI-01	9 (lab 3)	2	1
Neuropsychology	Engl.	Fabrizio Doricchi (3CFU) / Daniele Nico (3CFU)	M-PSI-02	6	2	1
Cellular and Molecular Neurobiology	Engl.	Maria Teresa Fiorenza	BIO/13	6	2	1
Clinical psychology	Engl.	tbe	M-PSI-08	6	2	1
Psychobiology of typical and atypical development	Engl.	Simona Cabib/Tiziana Pascucci	M-PSI-02	9 (lab 3)	2	2

Course descriptions:

Experimental methods in Social Neuroscience – Prof. Matteo Candidi
The course is intended to provide students with a broad presentation of experimental methods applied in social neuroscience. After an overview ofthe main theories guiding research in this field, the course will focus on neurophysiological methods (fMRI, EEG, MEG, brain lesions) used to study the neural underpinnings of social functions, from lower-level perceptual and motor functions (e.g. social vision, interpersonal motor coordination, social emotions and affect) to higher-order forms of social cognition (embodied cognition, theory of mind, empathy, stereotyping). Furthermore, the course will explain how non-invasive brain stimulation (TMS, tES) approaches are used to study and modulate neural processes underlying social functions.

Affective neuroscience across the lifespan – Prof. Anna Pecchinenda
The course aims at providing an in depth understanding of the main theoretical models and empirical evidence in the field of Emotions, Human Affective Neuroscience and Social Cognition. Particular emphasis will be given to recent experimental evidence on the relation between emotion and attention, emotion and memory, emotion and high cognifive functions, as well as to emotional changes occurring across the lifespan.
The course will provide students with the conceptual and methodological means to understand and critically analyse evidence on emotional processing and social cognition both in basic research as well as in clinical and applied contexts.

Perceptual and cognitive processing – Prof. Marialuisa Martelli
The course covers methodological and theorical issues on perceptual and cognitive functioning, learning and development from infancy into adolescence and adulthood. The interpretability of behavioural measures and their limits, and the nature of the probabilistic behaviour of decision-making are discussed. The main psychophysical paradigms, Signal Detection Theory together with the derived implication for threshold models, and the main cognitive models of the mind are presented.

The course expands on the nature of the information processing stages in perception and cognition. Practical and theorical competences in psychophysics and cognitive science are provided, as well as knowledge of the main computational models of the mind. Students will be encouraged to critically analyse current models of integration processing. These concepts and tools are presented in the context of understanding and assessing both adults and developing cognitive abilities (from birth to adulthood).

Students will be prepared in understanding the implications and applicability of the major models of information processing. They will be able to thoroughly compare different approaches on the basis of the psychophysical evidences in signal detection and recognition theory. Students will acquire practical skills pertaining the application of Signal Detection Theory; read graphs and understand their consistency with the

conclusions; design protocols for perceptual and cognitive assessment; formulate prediction and select the best model to account for decision data.

Cognitive Neuroimaging – Prof. Gaspare Galati
The course provides an overview of the application of brain imaging methods to study human cognitive and sensorimotor processes and to identify neural architectures underlying normal and abnormal cognitive functioning.

Students will be provided a solid background on the main techniques used to image the human brain in vivo, and of their application in the cognitive neuroscientific field; a critical view of the validity and the limits of knowledge on the human mind derived by the application of such methods; and a series of conceptual tools to personally and critically evaluate results obtained by research in the field of cognitive neuroimaging.

Individual differences in personality and temperament - Prof.. Laura Di Giunta
The course deals with the introduction of the main theories of personality and temperament over the course of development and with a particular attention to the implications derived by those theories. The first part of the course will aim to provide the students with knowledge about the main theories of personality and temperament. The second part of the course will aim to introduce the concepts of continuity and discontinuity of personality and temperamental patterns with a longitudinal perspective (i.e., taking into account different developmental trajectories) and in different interpersonal contexts (e.g., peers, family). The third part of the course will be focused on the international measures of temperament and personality over the life-course.
Students will be encouraged to understand the predictors and the outcomes of the developmental trajectories associated with personality traits and temperamental dimensions. Students will be also encourage to develop the ability to criticize personality issues with a cross-cultural perspective.
The goals of this course will be accomplished through several methods. The predominant mode of learning will be through classroom lecture and discussion and through assigned readings. There will be in-class assignments to allow students to apply what is learned in the classroom and through course readings. Finally, audio-visual materials (including films and videotapes) will be used in class when pertinent.

Data analysis and statistical testing in cognitive neuroscience – Prof. Grazia Spitoni
The course will present the methodology and the experimental designs of the research in neuroscience. It will cover classical topics such as perception, memory, learning and attention. The course will also cover subjects related to neuropsychological assessment (i.e. the concept of cut-off).

Engineering Psychology and Human Performance – Prof. Francesco Di Nocera

This course will be devoted to the connections between human performance and design. Based on the psychological perspective of human information processing, lessons will deal with the flow of information as it is processed by a human being: from the senses, through the brain, to action. Upon completion of this course, students will be able to identify how human ability contributes to the design of technology, understand the connections within human information processing and human performance, challenge the way they think about technology's influence on human performance, and show how theoretical advances have been, or might be, applied to improving human-machine interaction.

Learning Disabilities, Prof. Pierluigi Zoccolotti

Learning disabilities are characterized by inadequate development of specific academic, language, and speech skills. They include reading disability (dyslexia), mathematics disability (dyscalculia) and writing disability (dysgraphia). The course provides an understanding of these different disorders with reference to:
- Main cognitive models of the disturbances;
- Applicability of models developed for the English language to the description of the disturbances in Italian (Anglocentrism)
- Main diagnostic instruments for the analysis of the dyslexic and dysgraphic disturbances in Italian;
- Case examples;
- Rehabilitative experiences.

The course aims to provide basic information on the nature of the learning disturbances of written language (dyslexia and dysgraphia). Furthermore, it aims to provide basic competence on the use of diagnostic instruments and rehabilitative techniques on these disturbances. The course will focus on the analysis of the learning disturbances of written languages in Italian. The main models will be illustrated. Studies on English-speaking children will be presented as well as recent studies which compare languages with different degree of orthographic complexity.

The student will acquire basic knowledge on the characteristics of learning disturbances of written language (dyslexia and dysgraphia). In particular, the student will acquire information of the differentiation between disturbances in irregular (such as English) and regular (such Italian) orthographies.

Neuropsychology, Prof. Fabrizio Doricchi and Prof. Daniele Nico

Theoretical and practical knowledge of research methods will be discussed during the course. The student should learn to independently choose the most appropriate technique of investigation within the different contexts of clinical or experimental work.

The student will acquire the following skills: Knowledge of the theoretical basis of the most prevalent and well-established research techniques in both neuropsychology and cognitive neuroscience; 2) Autonomy in the use of the same techniques; 3) Selection and preparation of research projects on behavioral and clinical data and theoretical research.

Cellular and Molecular Neurobiology – Prof. Maria Teresa Fiorenza
The course is aimed at giving the students specific information on mechanisms that regulate neuronal circuits formation, maintenance and plasticity, as well as on the main neurotransmission systems, needed to understand: 1) the role played by genetic/epigenetic factors in nervous system structure and function; 2) mechanisms underlying the activity of neurotransmitters and neurotrophic factor; 3) how psychoactive molecules influence the neurotransmission; 4) structural and functional damages responsible for neurodegeneration. Issue of this course will be discussed in light of the experimental method and the most recent break-through of molecular/cellular biology and biotechnology.

Clinical Psychology, t.b.e.
The aim of this course is to supply the methodological and practical competences to be used in all the phases of the psycho-diagnostic process of clinical psychology, considering a given theoretical background and the specific characteristics of the current clinical case.

Psychobiology of typical and atypical development, Prof. Simona Cabib and Prof. Tiziana Pascucci

The course focuses on the mechanisms of brain plasticity in the developing and mature brain; far reaching influences of early experience; neurobiological bases of functional recovery in neurological diseases; learning induced plasticity in psychopathology; neural bases of psychotherapy. The course provides an understanding of the brain mechanisms underlying atypical neurodevelopment (e.g., genetic and metabolic diseases, autism spectrum disorders), focused on early detection of developmental delay in childhood and adolescence.

The course aims at developing the ability to utilize results from basic research on life long plasticity in the nervous system and its interaction with organization of cerebral circuits emerging from the effects of genetic and experiential factors, to understand the pathogenesis of mental disturbances and the efficacy of therapeutic intervention.

At the end of the course, students will acquire knowledge about the major theoretical models shared by the international Community about the psychobiological bases of developmental disorders.

The course will also offer practical experiences with several tools internationally used for the early diagnosis and intervention. Students will be eventually prepared to enter into international teams for advanced research in the field of atypical development.