UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Visual Neurosciences

2627-2-F1702Q014

Aims

KNOWLEDGE AND UNDERSTANDING
At the end of the course, the master's graduates have acquired:

- advanced knowledge and skills in the field of visual functionality, neurocognitive mechanisms of vision and their changes over the course of life.
- in-depth knowledge of basic and applied research technologies and tools in the neuroscience field.

ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING
At the end of the course, the master's graduates have acquired:

- ability to perform assessments of implicit and explicit visual efficiency related to the functioning of the Central Nervous System;
- ability to design experiments in the field of visual neuroscience.

JUDGMENT SKILLS
At the end of the course, the master's graduates have acquired:

- ability to critically analyse scientific literature in the field of Visual Neuroscience;
- ability to critically analyse and interpret data in the field of Visual Neuroscience;
- ability to critically analyse information in the field of instrumentation and technologies typical of Neuroscience.

COMMUNICATION SKILLS
At the end of the course, the master's graduates have acquired:

- ability to communicate and collaborate in work groups and in heterogeneous and interdisciplinary environments;
- ability to communicate with researchers in the field of Visual Neuroscience;

- ability to contribute to the scientific literature in the field of Visual Neuroscience;
- ability to carry out high-level dissemination activities of scientific culture, in particular about Visual Neuroscience;
- ability to understand and use fluently in written and oral form the English language, in particular in reference to disciplinary and technical lexicons.

LEARNING SKILLS
At the end of the course, the master's graduates have acquired:

- ability to learn from the analysis of multidisciplinary literature through the selection and combination of different sources of information, evaluating their reliability;
- ability to learn and promote the developments of scientific, technological and cultural innovation in fields related to Visual Neuroscience.

Contents

• Cognitive neuroscience and neuropsychology: definition and study techniques
• The central nervous system: areas and connections
• Nature and development of the visual connectome
• How neural activity results in visual perception
• How visual perception participates in complex functions such as reading and moving in space
• Asymmetries of the visual system and their influence on visual performance and oculomotor dynamics
• Cortical and subcortical plasticity of the visual cortex in the lifespan
• Visuo-perceptual disorders in brain-damaged patients
• Healthy and pathological decline of brain mechanisms underlying visual perception in the older population

Detailed program

The course will provide a general overview of how our brain allows us to see what we see and will delve into some issues with a psychophysiological and neuropsychological approach. Among the topics that will be discussed are: the fundamental neurocognitive mechanisms that support vision, their genetic component but also the great cortical plasticity that characterizes them and that allows recovery in pathological conditions. The role of the visuo-perceptual system in complex skills such as reading and movement in space will explored in depth.
The changes in the functioning of the visual system that characterize healthy and pathological aging will be illustrated and discussed.
Furthermore, some emerging neuroscientific techniques such as connectomics and high-resolution functional magnetic resonance imaging will be illustrated, but also a review of the more historical methods such as the anatomical-clinical correlation of patients with brain lesions, which together will allow the next generation of visual neuroscientists to progress in the field.

Prerequisites

Receptive and productive language skills.
Analytical abilities in understanding and reasoning.
Basic anatomical knowledge of the central nervous system.

Teaching form

The course is taught in English, mainly in a teaching format, but also interactive. It will be entirely in person.

During lectures: a) the contents of the course will be presented and explained with the help of slides and videos; b) questions for clarification and discussion will be asked; c) theoretical/methodological topics of particular interest will be discussed with the students; d) activities for the drafting and discussion of new research projects will be proposed and students will be given the opportunity to present the projects.

Textbook and teaching resource

Reference book:
Gazzaniga, M. S., Ivry, R. B., Mangun, G. R., George R., Mangun, Dani S., Bassett, Elizabeth A., Phelps (2026). Cognitive Neuroscience: The Biology of the Mind. 6th Edition. UK: W.W. Norton.

Further material will be posted on the e-learning pages associated with the course.

Semester

I semester

Assessment method

The final exam will be written with a mandatory oral exam.

The written exam consists of a closed-answer test (multiple choice questions) for extensive testing of preparation on the exam program

The oral exam will be in the form of an interview to discuss the written exam and additional topics covered in class.

The final grade takes into account the overall score obtained in the various parts of the exam, according to the following scale:

18: barely adequate knowledge, minimal application and interpretation skills;
19–22: sufficient knowledge of the fundamental content, with some application uncertainty;
23–26: fair knowledge, good application skills with some inaccuracies;
27–30: solid knowledge, mastery of the content, and good to excellent critical thinking skills;
30 with honors: fully adequate knowledge, full mastery of the content, excellent command of the language.

There are no ongoing tests.

Office hours

Prof. Roberta Daini: see https://www.unimib.it/roberta-daini

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING