Learning objectives

Knowledge and understanding

- Neurophysiological basis of methods and techniques of transcranial non-invasive brain stimulation (NIBS)
- Neurostimulation (Transcranial Magnetic Stimulation, TMS); neuromodulation (transcranial Electric Stimulation, tES)
- Specific structural (CT & MRI) and functional (PET & fMRI) neuroimaging techniques.
- Technological and neurobiological foundations of neuroscientific inference with neurostimulation and neuroimaging techniques.
- Main applications in neuropsychology, cognitive neuroscience and clinical psychology of the aforementioned techniques

Applying knowledge and understanding

- To promote the ability to use NIBS in neuropsychological and psychological clinical settings.
- To promote the ability to use neuroimaging techniques in neuropsychological and psychological clinical settings.

To promote the ability for an integrated use of NIBS and neuroimaging techniques in neuropsychological and psychological clinical settings.

Contents
Methods and techniques of neural non-invasive stimulation and modulation: TMS, tES. Methods and techniques of neuroimaging: CT, MRI, PET and, mainly, fMRI. Applications in cognitive neuroscience, neuropsychology and clinical psychology.

**Detailed program**

- Transcranial non-invasive brain stimulation (NIBS)
- Historical background about NIBS
- Methodological foundations of NIBS
- Transcranial Magnetic Stimulation (TMS): spTMS (single pulse), ppTMS (paired pulse), rTMS (repetitive), pattern stimulation.
- Transcranial Electric Stimulation (tES): tDCS (transcranial Direct Current Stimulation), tACS (transcranial Alternate Current Stimulation), tRNS (transcranial Random Noise Stimulation).
- NIBS and brain plasticity
- NIBS in cognitive neuroscience, neuropsychology and clinical psychology.
- NIBS in motor and neuropsychological rehabilitation: aphasia, unilateral spatial neglect, memory and dysexecutive deficits.
- NIBS in the treatment of psychiatric disorders and of chronic pain.
- In the neuroimaging module the student will learn the technical foundations of the main imaging techniques (CT, MRI, PET) and their application in clinical neuropsychology, cognitive neuropsychology and cognitive neuroscience.
- The student will learn the experimental design principles of anatomo-clinical correlation studies and activation studies and the relevant statistical techniques. Finally, the student will become familiar with modern functional connectivity techniques and meta-analytical techniques.
- In particular, the use of the imaging techniques will be presented in the context of two concrete case studies: learning disorders, mood disorders and pre-surgical assessments of the representation of linguistic functions.
- Ultimately, the student should become capable of designing his own –simple- experiments with the aforementioned techniques and to critically assess the relevant literature in both the areas of NIBS and neuroimaging.

**Prerequisites**

It is strongly advised that the CV includes having passed the following exams: Biology and Genetics, Anatomo-physiological Foundations of Psychic Activity and Physiological Psychology, Neuropsychology of the Adult and the Elderly.
Teaching methods
Room lessons, audio-visual material.

Assessment methods
Multiple-choice questions and open written questions on the topics of the course.

Textbooks and Reading Materials
- Sacco, K. (a cura di) [2012], Le neuroimmagini. Idelson Gnocchi, Napoli.