UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

ADVANCED SYSTEMIC NEUROPHISILOGY	
Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	BIO/09 (PHYSIOLOGY)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	NEUROBIOLOGY
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	1st semester (01/10/2021 - 14/01/2022)
ECTS	9
Lesson hours	72 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	D'ANGELO EGIDIO UGO (titolare) - 6 ECTS PALESI FULVIA - 3 ECTS
Prerequisites	Neuroanatomy and neurophysiology basis
Learning outcomes	Know and understand the neural basis of cognitive processes, the basis of computation modeling of single neurons, microcircuits and neural networks.
Course contents	Brain functional architecture - Structure, function, dynamics and control - Computation, coding, information - Interaction between sensorimotor and cognitive sub-systems - Closed-loop computation o Forward and inverse controllers o Error detection - Circuit mechanisms of learning and memory

- Circuit mechanisms of computation and information transfer
Multiscale organization of the nervous system
- Microscale: molecular and cellular aspects, neurons and microcircuits
- Mesoscale: multineuronal assemblies
- Macroscale: large scale networks
Instrumental analysis of integrated functions
- Techniques for the measurement of ensemble neuronal functions
- Analysis of distributed signals
- CT, PET
- TMS, EEG, MEG
- MRI (basis, diffusion and functional)
- Brain Atlases
- Connectomics
- The inverse problem: inferring source activity from ensemble signals

Multiscale modelling of nervous functions
- Principles of realistic brain modelling
o Single neuron models (Hodgkin-Huxley style)
o Microcircuit models
- Model simplification and large-scale models
- SNN theory
- Brain modelling
o Bayesian inference and model inversion
o The Virtual Brain
o Dynamics causal modelling

Applications
- Neurophysiology and neuropathology
- Neuroinformatics
- Neurobotics
- Neuromorphic computing

Teaching methods	Face-to-face lectures or by videoconference according to the regulations in force of covid pandemic situation. Possible seminars to expand the student knowledge.
Reccomended or required readings	D'Angelo-Peres FISIOLOGIA – Edi-ermes
Assessment methods	Oral exam: learning is verified by oral examination aimed at ascertaining the achievement of the educational objectives of the teaching. The subject of the exam is the contents of the lectures and educational seminars.
Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile