Neurosciences (part I)

Lecturers
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Course mnemonic
MEDI-G4411

ECTS credits
5 credits

Language(s) of instruction
English

Course period
First term

Campus
Erasme

Course content

Photonic imaging for cellular and molecular functional imaging. Photons: Photon detection, principles of conventional microscopy – photon recording, CCD camera, confocal microscopy. Biological material : fixed tissues and cells, in vitro tissues and cells, intravital microscopy. The markers : immunolabelling, chemical compounds, fluorescent proteins. Dynamic molecular methods : FRAP, FRET, BRET, photoactivation.

Neuroimaging:understanding the physical basis of functional and molecular medical imaging (MRI and nuclear medicine): structural, functional and molecular mapping of the brain - the processes involved in functional, metabolic or molecular neuroimaging. And the different existing tracers based on these principles. - Learn to quantify a medical image: identify the main physico-chemical parameters that modulate the imaging signal and measure them for the main imaging modalities - Applications to neurological diseases.

Experimental strategies to study neurotransmission and intracellular signalling. Molecular and cellular approaches: genetic targeting of neuronal populations, cellular and circuits characterizations. Electrophysiological approaches: extracellular recordings, patch-clamp technique on acute brain slices, multielectroderecordings, voltammetry. In vivo approaches: optogenetic, chemogenetic, Calcium imaging.

Objectives (and/or specific learning outcomes)

The objective of the course is to provide basic concepts in order to understand and apply the main techniques of in vitro functional imaging, photonic cellular and molecular imaging, and in vivo neuroimaging.

On completion of the course students#e#s will be able to comprehensively describe the basic principles of the main in vivo functional and molecular imaging techniques. To explain the physical principles behind MRI, SPECT and PET imagers and their main modes of operation. To justify the choice of a radiotracer, and to establish the characteristics of the main radioisotopes used.

Students#e#s will be able to explain the concepts of metabolic imaging, receptors and synthetic pathways in brain imaging.Define the two types of quantification: absolute vs. relative. State the different parameters that have an impact on the quantification of SPECT and PET images and how to correct them. Outline the different image analyses.

Finally, students#e#s will be able to explain the applications of functional and molecular imaging in various neurological diseases (Alzheimer's, Parkinson's, epilepsy, cancers). Explain the differential contribution of various imaging techniques to different neurological conditions.

Neurotransmitters act by modifying permeability of ionic channels and by activating multiple intracellular signalling pathways, therefore modifying activity of neuronal networks on a short- and long-time scale.

This course aims at students already mastering the concepts of basic neurosciences presented in the Bachelor part of their cursus.

This course presents trending topics in neurosciences and the related methods which allow their study.

Examples of physiopathological situations, due to alterations in neurotransmission and cell signaling are also discussed.

Pre-requisits and co-requisits

Pre-requisites courses

MORF-G3308 | Neurosciences | 5 crédits

Teaching method and learning activities

Ex cathedra lectures, demonstrations of techniques, analysis of research articles

Contribution to the teaching profile

The course contribute to the education in neurosciences by bringing knowledge on synaptic functioning, role of neurotransmitters and electrophysiological techniques.

It brings also knowledge necessary to implement and understand in vitro and in vivo imaging methods used in biomedical sciences.

References, bibliography and recommended reading

partim photonic imaging:

http://limif.ulb.be - the Light Microscopy Facility, Faculté de Médecine Campus Erasme

Course notes

Université virtuelle

Other information

Place(s) of teaching

Erasme

Evaluation method(s)

Oral examination

Evaluation method(s) (additional information)

Presentation and critical discussion of a research article.

Determination of the mark (including the weighting of partial marks)

The UE marks = arithmetic mean (without ponderation) of the respective marks for each UA.

In case of marks <10/20, the **lowest** marks will be the final marks for the entire UE, irrespective of the other marks.

For any UA with marks <10/20, exam must be retaken.

UA marks 10/20 or higher might be passed from one academic year to the next year, upon request to the respective teachers.

Main language(s) of evaluation

English and French

Programmes

Programmes proposing this course at the faculty of Medicine

MA-BIMED | Master in Biomedical Sciences | finalité Research/unit 1 and finalité Professional/unit 1