FACULTY OF MEDICINE

Approved by FUN 12 November 2019, valid from 12 November 2019

Research Programmes Board, FUN

Preclinical Imaging, MEPKAV1

3 credits **Third cycle**

General information

Preclinical medical imaging offers a range of techniques for present-day researchers. Among the techniques are magnetic resonance imaging (MRI), nuclear medicine methods such as positron emission tomography (PET) and single-photon emission tomography (SPECT), as well as advanced light microscopy and electron microscopy (EM). Several of the techniques require specialised knowledge for optimal use and selection of the appropriate technique. The course is primarily intended for doctoral students at the Faculty of Medicine but, space permitting, also for researchers with PhDs in need of training in preclinical imaging. The course runs for three weeks, part-time for the first two weeks and full-time in the last week. The first two weeks consist of lectures in the morning. The last week consists of laboratory exercises and work on and a presentation of an individual assignment.

Language of instruction

English

Objective

The aim of the course is to bridge the knowledge gap between existing technology and the participants' expertise, primarily through providing participants with the required basic knowledge of biomedical imaging and the practical tools for using the technique. The budding researcher will be able to acquire the knowledge needed to choose the technique that is best suited to the issue and establish a foundation for future activities.

Learning outcomes

On completion of the course, the participants shall be able to

- select the appropriate imaging technique for addressing a biomedical issue
- explain similarities and differences between different imaging techniques
- explain the potential and limitations of each technique
- account for the work flow in association with the management of animals in imaging

Content

• MRI

- Basic components of an MR system and relaxation effects (T1, T2, T2*)
- Relaxation effects (T1, T2, T2*)
- Development of image contrasts through the interaction between relaxation and machine parameters such as TR, TE
- The principles of image production through MR
- Basic pulse sequences such as spin echo and gradient echo
- The relationship between signal, noise, resolution and other image parameters
- The mechanisms of the use of contrast agents
- Measurement of perfusion (microcirculation) using MR
- Specific issues of using high field values in preclinical MR
- Functional techniques such as fMRI, DWI, MRS

• PET/SPECT/CT and radiochemistry

- Technical principles of PET, SPECT and CT
- Application areas
- Similarities/differences between PET and SPECT and their scope for quantification
- Practical work flow from injection to image and image analysis
- The most common radionuclides and tracers, and the work to produce radiotracers

• TEM/SEM and advanced light microscopy

- Technical principles of the different microscopes included on the course
- Application areas and similarities/differences between light microscopy and electron microscopy
- Sample preparation methods and work flow, and analysis and post-processing (for example using virtual reality) of microscopy data

• Ethical aspects of animal management

Design

The first two weeks consist of lectures on the topics described under Content and are run part-time. The last week is run full-time and consists of laboratory exercises in groups of three and presentations of individual projects. The projects are to deal with the use of preclinical imaging for a specific research issue of relevance to the participants. The project assignment is to be selected in consultation with a lecturer on the course and must be approved by the course directors. The assignment is to be of the kind that requires group work but each student is to report on their part in speech and writing. Participation in lectures, laboratory exercises, and submission and reporting of assignments is compulsory. If a student is absent from a laboratory exercise, they can re-take it at a suitable moment in conjunction with the course. In the case of many absences, the student needs to re-take the whole course.

Assessment

The assessment is based on an individual project reported in speech and writing in accordance with the description under Design. The special design of the project assignment makes it possible to determine whether the learning outcomes have been achieved or not. In addition to this, all course components are to be regarded as compulsory.

Grades

The grades awarded are Pass or Fail.

Admission requirements

To be admitted to the course, applicants must have a degree in medicine, biomedicine, engineering or science, and be admitted to research studies in one of these areas.

Required reading

Research articles required for completing the individual assignment.