DEPARTMENT OF CLINICAL NEUROSCIENCE

K8F6044, Principles and Practices of Nuclear Medicine, 1.5 credits (hec)

Principer och praxis för nuklearmedicin, 1,5 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by The Committee for Doctoral Education on 2024-09-20, and was last revised on 2025-09-07. The revised course syllabus is valid from spring semester 2026.

Responsible department

Department of Clinical Neuroscience, Faculty of Medicine

Prerequisite courses, or equivalent

Basic knowledge of biochemistry, pharmacokinetics/-dynamics, cancer and neurodegenerative diseases is expected. The following short online modules on radiation safety will need to be completed before the start of the course (link will be provided to all course participants): 'Introduction to radiation protection' and 'Open radioactive sources'. These online modules take 1 hour or less each. The module 'Open radioactive sources' also includes an in-person lecture, however, this lecture is part of the course – so the lecture does NOT need to be attended prior to the course.

Purpose & Intended learning outcomes

The purpose of the course is for participants to obtain broad knowledge on state-of-the-art (pre)clinical nuclear medicine. Moreover, the course provides a practical guide on how to work with open radioactive sources in a wet lab environment. The course explains the basics of radioactive decay and how radioactive molecules could be used in the (pre)clinical setting for diagnostics and personalised therapy, with a strong focus on applications in oncology and neurology (Alzheimer's, Parkinson's, other). The course will introduce the latest developments in the field, covering radiation physics and biology, radiochemistry and translation of theranostic vectors and, importantly, will train the participants in handling radiopharmaceuticals. As such, participants will learn the fundamentals of modern nuclear medicine.

Knowledge and understanding

The student should be able to:

1. account for and explain radiation is, how it can be visualised using (pre)clinical techniques, how radioactive particles interact with matter and what the effects are of this interaction
2. account for and explain the latest developments in the field of nuclear medicine
3. give examples of how radiopharmaceuticals can be used for the diagnosis and therapy of patients with oncological and neurological illnesses (Alzheimer's, Parkinson's, other)
4. demonstrate up-to-date knowledge of radiation safety rules and waste handling

Competence and skills

The student should be able to:

1. demonstrate the required practical skills for handling radiopharmaceuticals and other open radioactive sources
2. demonstrate the ability to analyse the purity of radiopharmaceuticals using simple radio-analytical techniques

Judgement and approach

The student should be able to:

1. describe the possibilities and limitations of using radiopharmaceuticals for personalised medicine

Course content

Lectures

- Radiation physics (atom models, radioactive decay)
- Interaction with matter (alpha, beta, gamma, neutrons)
- Biological effects and risks
- Radiation protection (alpha, beta, gamma, neutrons, ALARA)
- Visualisation & imaging (autoradiography, PET, SPECT, Cerenkov)
- Radiopharmaceutical therapy
- Theranostics
- Rules & regulations in Sweden (licensing, waste, transport)
- Practical radiation safety at Karolinska (prevention of internal/external contamination)

Practical session

- How to prepare for radioactive work?
- Practise with 'cold' materials (handling using tweezers, open/close vials, adding/mixing reagents)
- Perform simple radiolabelling using short-lived radioisotope
- Analysis of radiopharmaceuticals (iTLC, radio-HPLC)
- Clean up and radioactive waste disposal

Examination day

- Oral presentations
- Group discussions

Forms of teaching and learning

The course will consist partly of lectures given by experts in the field and partly of practical training in a laboratory environment. Additionally, students will participate in group assignments (case studies, buzz groups). On the last day of the course, students will give an oral presentation, during which they describe a (fictional or actual) radiopharmaceutical experiment/procedure that they are going to conduct. They will discuss each topic addressed during the course, based on a standardised presentation template provided by the course leader. Each presentation is followed by questioning by an opponent (fellow student) as well as a group discussion.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

Full attendance is compulsory. Absence will need to be compensated by a written report addressing the missed topic based on a literature review and in agreement with the course leader.

Forms of assessment

Students will be formatively assessed during in-class discussions, group assignments and using short, interactive quizzes at the end of each teaching block. Entry points and exit tickets will be used during lectures to enhance student engagement and assess gained knowledge. Students will be summatively assessed based on their oral presentations and role as opponents (content knowledge, ability to answer and ask relevant questions). Furthermore, their practical handling of open radioactive sources in a lab environment will be assessed. All students will be assessed individually.

Course literature

Recommended course literature and hand-outs will be made available prior to the course.