DEPARTMENT OF CLINICAL NEUROSCIENCE

K8F6064, PET in Neuroscience with a Focus on Radiochemistry , 1.5 credits (hec)

PET inom neurovetenskap med fokus på radiokemi, 1,5 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by the The Committee for Doctoral Education on 2025-02-20, and is valid from autumn semester 2025.

Responsible department

Department of Clinical Neuroscience, Faculty of Medicine

Prerequisite courses, or equivalent

No prerequisite courses, or equivalent, demanded for this course.

Purpose & Intended learning outcomes

Purpose:

This course seeks to provide students and specialists with adequate theoretical and practical knowledge of Positron Emission Tomography (PET) as well as its area of radiochemistry. The course is designed to facilitate the integration of the more conceptual aspects of radiochemistry and the practical work with the development of PET radioligands for clinical and preclinical purposes. This course is designed for doctoral students in biomedical sciences, radiopharmacy, medicinal chemistry, radiochemistry, and related fields. It may also benefit researchers and professionals with a PhD degree seeking to expand their knowledge in medical imaging and radiochemistry.

Intended Learning Outcomes

By the end of this course, students will be able to do the following:

- Explain the main principles of PET imaging.
- Describe the contributions of radiochemistry to the design and development of PET radiotracers, especially in the aspects of radioisotope labeling.

• Demonstrate practical skills in the synthesis and characterization of PET radioligands, safety measures, and quality control in radiochemistry.

• Analyse the ethical issues of other applications of PET technology in research and clinical practice, fostering thinking about future changes and challenges in the field.

• Use knowledge of PET and radiochemistry in interdisciplinary research in neuroscience and other biomedical disciplines, facilitating research collaboration.

Course content

The course will be structured as follows:

Module 1: Introduction to PET Imaging

-Basic principles and technology of PET

-Applications of PET

Module 2: Fundamentals of Radiochemistry

-Basics of radiochemistry and radioactivity

-Design and synthesis of radiotracers for PET

-Quality control and regulatory considerations

Module 3: Laboratory Practical

-Hands-on experience in radiotracer synthesis

-Radiotracer characterization techniques

-Safety protocols and ethical considerations in radiopharmaceutical research

Forms of teaching and learning

The teaching methods employed in this course include teacher-led lectures, practical lab sessions, group discussions, and self-study. Attendance is mandatory, and active participation in all sessions is required. The course is conducted on-campus, providing students with access to various types of course content, including lecture slides and recommended readings. Additionally, students can engage with their peers and course instructors, particularly during group discussions.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

Participation in lectures, practical sessions, group discussions, exams, and oral presentations is mandatory. Students may discuss special reasons for absence with the course organizers. Any absence from these components will be compensated with a written assignment.

Forms of assessment

Students will be assessed through a combination of written exams, practical lab assessments, presentations, and a final project that focuses on a relevant aspect of PET and radiochemistry. This varied approach will ensure a comprehensive evaluation of both theoretical understanding and practical skills.

Course literature

The course literature primarily consists of review articles on recent advances in PET radiochemistry and the synthesis of radiotracers for PET imaging, focusing specifically on both common and emerging radiotracers used in neuroscience. Students will receive materials and handouts in advance to prepare for various activities and the examination. The following review articles are recommended for the course:

1. Pike VW: The status of PET radiochemistry for drug development and evaluation. Drug information journal: DIJ/Drug Information Association 1997, 31:997-1013.

2. Jacobson MS, Hung JC, Mays TL, Mullan BP: The planning and design of a new PET radiochemistry facility. Molecular Imaging & Biology 2002, 4(2):119-127.

3. Dahl K, Halldin C, Schou M: New methodologies for the preparation of carbon-11 labeled radiopharmaceuticals. Clin Transl Imaging 2017, 5(3):275-289.

4. Deng X, Rong J, Wang L, Vasdev N, Zhang L, Josephson L, Liang SH: Chemistry for Positron Emission Tomography: Recent Advances in (11) C-, (18) F-, (13) N-, and (15) O-Labeling Reactions. Angew Chem Int Ed Engl 2019, 58(9):2580-2605.

5. Wang Y, Lin Q, Shi H, Cheng D: Fluorine-18: Radiochemistry and Target-Specific PET Molecular Probes Design. Front Chem 2022, 10:884517.

6. Rong J, Haider A, Jeppesen TE, Josephson L, Liang SH: Radiochemistry for positron emission tomography. Nat Commun 2023, 14(1):3257.