# Three Postgraduate Courses in Nuclear Medicine

We have the pleasure of inviting you to three PhD courses in nuclear medicine physics, organised by Medical radiation physics, Lund university, in collaboration with nuclear medicine, Region Skåne. Please see below for details on each of these courses.

As an entry requirement, you need have a degree from a medical physics programme or an equivalent undergraduate degree.

Depending on who is participating and who is lecturing, lectures will be held in English or Swedish.
Each course will be examined separately, and will have a separate course code in Ladok.

Courses are free of charge for postgraduate students.

Please note that **each course needs to be registered for separately** by sending an e-mail to adresses indicated below.


Kind regards,

*Johan Gustafsson, Katarina Sjögreen Gleisner, Jenny Oddstig, Michael Ljungberg*

*Medical radiation physics, Lund university & Nuclear medicine, Region skåne*

# Course 1. Nuclear Medicine: Instrumentation and Image Generation, 3 credits

**Aim**: The aim is to provide the doctoral student with in-depth knowledge of image-generating systems and techniques in clinical nuclear medicine, especially with regards to tomography. The theory of tomographic reconstruction with iterative methods and their implementation in clinical SPECT and PET will be reviewed in detail, including the use of artificial intelligence for this purpose. Furthermore, camera designs for these systems will be described in detail, including combination systems and non-standard systems.

**Course content**: *Detectors for gamma cameras and PET, gamma-camera systems and gamma-camera geometries, collimation principles, PET-systems and PET-system geometries, hybrid systems, PET and SPECT reconstruction, AI tools in PET and SPECT*

- **Dates:** Lectures: December 9, 2024 - December 13, 2024
- Oral follow-up on reports: Individually planned January 15 to January 16
- **Location:** The course and follow-up will be held on Zoom.
- **Registration:** *November 25* at the latest. Please send an e-mail to johan_ruben.gustafsson@med.lu.se stating that you wish to register to the PhD course "Nuclear medicine: Instrumentation and image generation". We may come back with request for personal details for Ladok.
- **Assessment**: Assessment is based on attendance at lectures, submission of a written report, peer-review of another course attendants report, and a short oral follow-up of the report.
- **Requirements to obtain the credits**: At least 90 % attendance at lectures, an approved written report, approved peer-review, and approved oral follow-up.

# Course 2. Radiopharmaceuticals and dosimetry, 3 credits

**Aim**: This course intends to provide an overview of new radiopharmaceuticals in medical applications, covering diagnostics, therapy and theragnostics. This includes principles of carrier substances and uptake mechanisms, methods for radionuclide production, characterization of radionuclides at standard metrology institutes, and principles of metrological traceability with application to activity measurement. Furthermore, internal dosimetry methods will be covered with application to solid organs and bone marrow, as well as dosimetry at different levels including macro-, mini- and micro-scale. Lastly, the course will include an orientation about current changes concerning regulatory and market aspects in nuclear medicine, the availability of radiopharmaceuticals, and the implementation of personalised dosimetry.

*Content:  Radionuclide production, measurement and establishment of radionuclide data, radionuclide calibrator, metrological traceability, novel radiopharmaceuticals with medical applications in diagnostics, therapy and theragnostics, carrier substances and uptake mechanisms, internal dosimetry methods, software for internal dosimetry, example calculations for solid organs and bone marrow, small-scale dosimetry, micro dosimetry, evidence for dose-effect relationships in therapeutic nuclear medicine, changes in the radiopharmaceutical market, regulatory changes and debate on patient-specific dosimetry.*

- **Dates:** Lectures: January 20, 2025 -  January 24, 2025.
  Oral presentations: February 4 and 5, 2025
- **Location**: The course and oral presentations will be held on Zoom.
- **Registration:** *December 9* at the latest. Send an e-mail to: katarina.sjogreen_gleisner@med.lu.se stating that you wish to participate on this PhD course "Radiopharmaceuticals and dosimetry". We may come back with request for personal details for Ladok.
- **Assessment**: - is based on attendance at lectures, submission of a presentation material with detailed explanatory comments on each presentation page, oral presentation of this presentation material, and peer-opposition.
- **To obtain the credits**: - you are required to attend at least 90% of the lectures, demonstrate an approved oral presentation, an approved peer-opposition and an approved written presentation material.

# Course 3. Nuclear Medicine: Modelling of Camera Systems, 3 credits

**Aim:** The aim is to introduce the PhD students to the Monte Carlo methods used for simulation of photon interactions and radiation transport, and mainly regarding applications in Nuclear Medicine Image generation.

**Course content:** *The theories behind photon interactions will be reviewed in detail along with different types of methods and algorithms that allow these theories to be effectively implemented in Monte Carlo programs for SPECT and PET. The SIMIND programme, developed at Lund University for simulation of scintillation cameras, is the programme that will form the basis for the practical part of the course, and an in-depth presentation of the programme's structure, possibilities and limitations will be given. The application areas of the program will be discussed, and the course participants will use the program in practical exercises to solve problems and study phenomena relevant to Nuclear Medicine imaging with systems based on scintillation cameras. Coupling of Monte Carlo simulated images with SIMIND to tomographic reconstruction programs and to the analysis programs ImageJ and gnuplot will be described.*

- **Date:** February 24, 2025 - February 28, 2025
- **Location:** This course will be held on site at the Medical Radiation Physics in Lund. Because a significant part of the course will include computer excercises, the number of participant will be limited.
- **Registration:** *February 3, 2025* at the latest. Send an e-mail to: michael.ljungberg@med.lu.se stating that you wish to participate on the PhD course "Modelling of Camera Systems". We may come back with request for personal details for Ladok
- **Assessment**: -Based on attendance at lectures and performing the computer-tasks related to these.
- **To obtain the credits**: You are required to attend at least 90% of the lectures and you need to perform all of the computer exercises and write a report on these.