What Life Scientists Should Know About Molecular Imaging

Nuclear Imaging: Physical Principles and Instrumentation

Principles of PET and SPECT
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Learning Objectives:

- Be able to explain the tracer principle and its importance in PET and SPECT molecular imaging
- Be able to explain to your peers how radiation emitted from the body is detected externally using SPECT and PET instrumentation
- Be able to explain the key principles in forming a reconstructed image of the tracer distribution in the body

This unit of study explores the principles and methods that underpin two key molecular imaging techniques based on the radioactive tracer principle: single photon emission computed tomography (SPECT) and positron emission tomography (PET). Topics covered include the radioactive tracer principle, radioisotope production and decay, radiation transport in tissue, radiation detection,

PET and SPECT instrumentation and tomographic image reconstruction. On completion of this lecture, students will have a basic understanding of the imaging chain as it relates to PET and SPECT, starting with the emission of radiation in the body, leading to its external detection and, finally, a reconstructed image of the radioactive tracer distribution in the body. The factors affecting the accuracy and noise properties of molecular images will be briefly explored. Students will also have an appreciation of how to use these imaging technologies to exploit the properties of the radioactive tracer principle and make estimates of important physiological parameters.