What Life Scientists Should Know About Molecular Imaging

Nuclear Imaging: Physical Principles and Instrumentation

PET and SPECT Based Hybrid Imaging Systems

Robert Miyaoka
Radiology, University of Washington, Seattle, Washington, USA

Learning Objectives:

- To become acquainted with a range of hybrid imaging methods, their rationale and principles.
- To develop an appreciation of the applications of clinical and preclinical hybrid imaging.
- To gain an understanding of technical challenges facing designers of hybrid imaging systems, and recent technological innovations.
- To be familiar with potential sources of artifacts in hybrid imaging and how they may be counteracted.

A theme in medical imaging is that two images combined together can often provide more than twice the information as one. The two images can be a functional (e.g., PET or SPECT) and an anatomic image (e.g., CT or MRI); images from two different pharmaceuticals or contrast agents; or images before and after therapy. In this session we will focus on nuclear medicine based hybrid imaging systems (e.g., PET/CT and SPECT/CT). We will begin with an overview of the rationale for hybrid imaging both for clinical and pre-clinical applications. We will describe the synergistic benefits of these systems. We will then discuss the different types of nuclear medicine hybrid instrumentation. The main focus will be on PET/CT and SPECT/CT as they have the largest user base. However, we will also cover PET/MRI, SPECT/MRI, and other types of hybrid imaging systems. We will cover the challenges (i.e., imaging artifacts) associated with hybrid imaging systems and also the benefits of having multiple sets of complementary data. Finally, we will go over the special data processing requirements that are necessary and available for the various imaging combinations.