

# From the basement to forefront of imaging: the future of nuclear medicine

## Current status of the field

Nuclear medicine and positron emission tomography (PET) continues to be on the forefront of molecular imaging. In the past decade, PET imaging established itself as the gold standard for cancer staging and therapy follow up. To lesser extent, PET is also used clinically in cardiology (myocardial perfusion) and neurology (dementia). The wide adoption of oncology applications of FDG PET imaging drove technology development towards (1) improvements in image quality and (2) integration with anatomical imaging. PET image quality improvements were achieved by novel detector design, commercialization of the time of flight PET & advances in patient motion management. Today, almost all new PET systems are integrated with diagnostic CT scanners. Combination of anatomical detail provided by CT with metabolic / molecular information from PET improved diagnostic accuracy and proved the usefulness of multimodality imaging in a routine clinical setting.

## Future directions for the field

PET imaging is already undergoing a significant change — a shift from disease detection towards disease characterization. From imaging technology perspective, it means a move towards quantitative imaging. Quantitative PET imaging means reliable, consistent system performance, accurate absolute measurement of activity concentration and parametric imaging of specific biomarkers (dynamic imaging & pharmacokinetics). There is also growing consensus that a composite picture of several biomarkers will be necessary to characterize the disease. Integration of PET & MR imaging could enable such characterization by leveraging molecular imaging potential of both modalities. These technical developments combined with the development of novel radiopharmaceuticals could enable the use of PET imaging for planning and monitoring of individualized targeted therapies fulfilling a dream of molecular medicine.

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