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**IN VIVO MOLECULAR SMALL ANIMAL IMAGING BY PET AND OPTICAL IMAGING**Jung-Joon Min, M.D., Ph.D.*Department of Nuclear Medicine, Chonnam National University Medical School, Gwangju, Korea*

Recent progress in the development of non-invasive imaging technologies continues to strengthen the role of biomedical research. These tools have been validated recently in variety of research models, and have been shown to provide continuous quantitative monitoring of the location(s), magnitude, and time-variation of gene delivery and/or expression. The studies published to date demonstrate that noninvasive imaging tools will help to accelerate pre-clinical model validation as well as allow for clinical monitoring of human diseases. Molecular imaging usually exploits specific molecular probes as the source of image contrast. This change in emphasis from a non-specific to a specific approach represents a significant paradigm shift, the impact of which is that imaging can now provide the potential for understanding of integrative biology, earlier detection and characterization of disease, and evaluation of treatment. There are several important goals in molecular imaging research, namely: (1) To develop non-invasive in vivo imaging methods that reflect specific molecular processes such as gene expression, or more complex molecular interactions such as protein-protein interactions; (2) To monitor multiple molecular events near-simultaneously; (3) To follow trafficking and targeting of cells; (4) To optimize drug and gene therapy; (5) To image drug effects at a molecular and cellular level; (6) To assess disease progression at a molecular pathological level. The development, validation, and application of these novel imaging techniques in living subjects should further enhance our understanding of disease mechanisms and go hand in hand with the development of molecular medicine. This presentation reviews the use of PET and optical imaging technologies as they have been used in imaging biological processes for molecular imaging applications.

**Key Words:** Molecular imaging, PET, Optical imaging