Radioactive optical imaging and 'quantum dot' nano-imaging at the forefront of molecular medicine

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During SNM's 57th Annual Meeting, investigators presented the results of a multidisciplinary study involving the capture of radiation luminescence and radioactive-excited nanoparticles to help detect subtle signs of disease. Currently, nuclear medicine agents and imaging technology image the behavior of particles at the cellular, molecular and atomic levels, but radioactive materials also emit barely visible light that can be detected with highly sensitive optical imaging technology. This discovery could lead to new, state-of-the-art imaging techniques.

"The need for this study became evident with the rise of new molecular imaging research and multimodality imaging instruments and probes, which could provide better and earlier diagnosis for a variety of diseases," said Zhen Cheng, Ph.D., co-author of the study and assistant professor of radiology at Stanford University. "The research presented here bridges nuclear imaging and optical imaging. It represents a new avenue for molecular imaging research, and is expected to have many applications for medical and bionanotechnology research as well as clinical imaging."

Study researchers focused on a low-energy window of light from the visible and near-infrared band of the electromagnetic spectrum. This is not visible to the human eye, but can be detected with very precise optical cameras picking up light energy from the charged particles of radioactive sources. Researchers tested commonly employed molecular

imaging agents used to detect a range of biological processes within the body. Imaging agents utilized in the study include fluorine-based 18F-FDG and Na18F, sodium iodide-based Na131I, yttrium-based 90Y-Cl3, as well as a 90Y labeled peptide that specifically target tumors.

Findings indicate that radioactive molecular probes and nano-imaging techniques using radiation luminescence and widely studied fluorescent nanoparticles known as "quantum dots" could potentially be used for non-invasive functional imaging with optical imaging systems. Not only could this have a significant impact on the early detection and diagnosis of disease, but these and resulting techniques could also be applied to future applications in image-guided therapy.

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