Molecular Imaging of Cancer

Over the past decade, molecular imaging has evolved into an important tool for diagnosing and monitoring the progression of diseased tissues. The field of molecular imaging has established itself as a distinguished discipline that combines the principles of imaging technology (nuclear medicine, MR, optical imaging, and ultrasound) with molecular and cell biology in order to understand complex molecular processes.

One area where molecular imaging is making significant strides is in imaging and monitoring the treatment of cancer. Cancer is a challenging disease, characterized by uncontrolled cell division and the ability of these cells to invade other tissues. Also, cancer is biologically heterogeneous, and thus a specific type of cancer may vary significantly between individuals. This creates a strong impetus for developing individualized targeted cancer therapies. Molecular imaging holds promise in meeting this goal with its ability to detect cancer-specific biomarkers such as growth factor receptors, protein kinases, cell adhesion molecules, proteases, as well as biological processes such as hypoxia, apoptosis, and angiogenisis.

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Along with improved target selection, molecular imaging is also benefiting from advances made in probe development and instrumentation. Research in this area has led to the development of many types of tumor receptor- and enzyme-targeted agents, including activatable fluorescent probes, quantum dots for optical imaging, microbubbles for ultrasound, and ferromagnetic compounds for MR imaging. The recent Annual Meeting

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Self-Assessment Credit: What SNM Is Doing to Help

The SNM Lifelong Learning & Self-Assessment Program (LLSAP) modules are designed to simplify the process of earning the self-assessment credits now required by the American Board of Nuclear Medicine (ABNM) and the American Board of Radiology (ABR) for maintenance of certification (MOC). LLSAP modules have been approved for self-assessment credit by the ABNM and ABR and are available online at www.snm.org/llsap. In addition to information about current and future modules, the site contains detailed information on maintaining certification.

Twenty-three modules are currently available in the following categories:

- Basic Science: Physics and Instrumentation
- Cardiology
- Endocrinology
- Gastrointestinal Motility
- Neurology SPECT and PET
- Oncology CT
- Oncology PET/CT

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Each module contains an informative syllabus focusing on the latest research and developments within a specific topic. Many modules include links to the literature (e.g., review articles and Web sites), multimedia (video or animation), and useful tables and figures. The modules include multiple-choice, board-type questions with clinical background, images, critiques, and interactive cases. Many modules use Digital Imaging and Communications in Medicine datasets as part of the interactive materials to simulate real-world image reading and interpretation.

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Optical Glutamate Sensor for Synaptic Transmission

Namiki et al. from the Nagoya University Graduate School of Medicine (Japan) reported in the April issue of the *European Journal of Neuroscience* (2007;25:2249–2259) on the development of a novel glutamate probe capable of producing high-resolution optical images of glutamate release. The probe, which includes a glutamate receptor (GluR2) subunit and a small-molecule fluorescent dye, was designed to report on microenvironmental protein conformational changes elicited by glutamate binding. The authors were able to demonstrate in situ spatial mapping of synaptically released glutamate after presynaptic firing and obtained images that reflect the results of even a single firing. These and additional investigations indicated that the probe can be "generally applicable to evaluation of presynaptic modulation and plasticity" and that this imaging method "is useful to address numerous fundamental issues about glutamatergic neurotransmission in the central nervous system."

European Journal of Neuroscience

Peptide-Based MR Contrast Agent in Alzheimer's Disease

In an article-published on May 15 ahead of print in the *Journal of Pharmacology and Experimental Therapeutics*, Kandimalla et al. from Florida A&M University (Tallahassee, FL) reported on the plasma and brain pharmacokinetics of a novel MR contrast agent based on a derivative of human amyloid-β peptide previously shown to cross the blood–brain barrier (BBB) and bind to amyloid plaques in mouse models of Alzheimer's disease (AD). They found rapid plasma elimination but also rapid absorption at the BBB. Additional studies indicated the preferential localization of the contrast agent on the amyloid plaques for extended periods of time, with indications of excellent signal-to-noise ratios for longer MR scanning times. These and other characteristics elicited in the study indicated that the contrast agent shows great promise in plaque targeting. The study provided valuable pharmacokinetic information that can inform dose, mode of administration, and scan times for future in vivo MR imaging of amyloid plaques in Alzheimer's disease transgenic mice.

Journal of Pharmacology and Experimental Therapeutics

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of the SNM in Washington, DC, highlighted advances in these areas and underscored the abundance of new radiopharmaceuticals for cancer imaging with PET and SPECT. Researchers are also using the unique properties of nanoparticles for designing improved cancer imaging probes. Some other examples of cancer-selective probes include the development of high-impact agents for targeting key cancer biomarkers such as $\alpha^v\beta^3$ integrin, σ2 receptors, bombesin receptors, and a host of new receptors being discovered by technologies such as in vivo phage display.

Based on these encouraging results, proponents of personalized and targeted anticancer therapy are making a strong case in favor of inclusion of molecular imaging into clinical trial design. It is also a powerful tool with which clinicians can noninvasively assess the phenotypic signature of a tumor in an individual patient.

A survey of recent research indicates that new and improved molecular imaging strategies are surfacing at a rapid rate. This is a harbinger of success for molecular imaging in the diagnosis and treatment of cancer.

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Each module is designed to allow the user to work toward meeting Part II (Lifelong Learning and Self-Assessment) of the MOC requirements, earn continuing education credits (2.5–4.0 credits per module), assess medical knowledge and patient care competencies, and enhance knowledge of clinical applications of the latest technologies. The LLSAP approach offers instant access to educational materials, with all work completed online. Users can save work in progress on each component, interrupting a session and coming back to it later. Once all questions are answered, immediate access to scoring and a detailed peer-comparison scoring report are available. Continuing education certificates can be printed and downloaded directly from the site. Once released, modules remain available for 3 years. LLSAP modules are currently available to SNM members at "4 for 3" pricing, which allows members to obtain at a discounted rate the 8 self-assessment credit hours required annually by the ABNM.

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