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INVITED LECTURE - Reactor production of radionuclides for molecular imaging and targeted radiotherapy

Wednesday 19 September 2012 09:50 (20 minutes)

The University of Missouri Research Reactor Center (MURR) was instrumental in the development of two commercialized radiotherapeutic agents: Sm-153 [Quadramet⊠] for the palliation of pain due to metastatic bone cancer, and Y-90 labeled glass microspheres [Therasphere⊠] for the treatment of liver cancer. MURR is now actively developing other radionuclides with potential for use as targeted radiotherapy of cancer. One approach focuses on attaching a radionuclide via a bifunctional chelator to a selective targeting biomolecule such as a peptide or an antibody. A second approach is the use of nanoparticles in which the nanoparticle is comprised of the radionuclide and allows for the delivery of multiple radionuclides per targeting moiety. Radionuclides for therapy have unique half-lives (dose rates) and beta energies (tissue penetration ranges) and in addition some have a low abundance of gamma emissions that allow for imaging and tracking dosimetry. Radiotherapy with the new targeting moieties requires a diverse library of radionuclides to meet their specific needs. For instance, radiolabeled peptides, antibodies and nanoparticles have shown promise for diagnosis and radiotherapy of cancer by targeting receptors over-expressed on tumor cells. Due to the low concentration of tumor-associated antigens, high specific activity radionuclides and/or novel nanoparticle complexing techniques are required. Current efforts at MURR have focused on developing high specific activity radioisotopes that can be attached to biomolecules, readily converted into nanoparticles and or incorporated onto nanoparticles and are taken up selectively by diseased tissues; they deliver radioactivity for diagnosis or treatment of disease selectively and minimize or spare damage to healthy or normal cells. These tumor targeting biomolecules can be radiolabeled with different radioisotopes tailored to treat different cancers and diverse patient needs. The reactor production of radionuclides and their incorporation into nanoparticles and biomolecules will be discussed in the context of their physical and chemical properties as related to their potential utility in medical research.

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