THE KEY ROLE OF CHEMISTRY IN THE DEVELOPMENT OF RADIOPHARMACEUTICALS FOR NUCLEAR MEDICINE

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Nuclear medicine has become a powerful tool in the area of personalized care, especially in oncology. Labeling molecules with γ or positron emitters allows the visualization of tumors with nuclear imaging techniques (respectively SPECT and PET) while the same molecules labeled with β^- or α emitting radionuclides can be used for targeted radiotherapy. "See what you treat and treat what you see" is made possible through the use of radiotheranostics. Indeed, imaging agents can be used to detect the disease, select patients likely to respond to the treatment with a therapeutic analog, and then monitor the efficacy of this treatment. The recent success of two radiopharmaceuticals, Lutathera® and Pluvicto®, both ^{177}Lu radiolabeled molecules, for the treatment of neuroendocrine tumors and prostate cancer respectively, has revolutionized the field of nuclear medicine. These therapeutic compounds were developed alongside their PET imaging companions, labeled with ^{68}Ga. Another growing field of research is the combination of nuclear imaging with another imaging modality, such as optical imaging for fluorescence-guided surgery.

In this highly interdisciplinary research field, chemistry plays a crucial role. The synthesis of radiometal chelators,[1] fluorophores,[2] multivalent platforms,[3] targeting vectors, as well as the implementation of innovative strategies, including click chemistry or supramolecular chemistry, to assemble the different components of a radiopharmaceutical compound,[4] are of major importance for the development of radiotheranostics or multimodal imaging agents with optimal pharmacokinetics and imaging and/or therapeutic efficacy.

Reference(s)

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