

EL8. Therapeutic Radiopharmaceuticals

Richard M. Lambrecht

Eberhard-Karls-Universität Tübingen, PET-Zentrum des Universitätsklinikum, Germany

Therapeutic nuclear oncology is recognized as one of the significant new frontiers benefiting from improved radiopharmaceuticals. Recent progress with: ^{188}W - ^{188}Re and ^{166}Dy - ^{166}Ho generators; the concept of a ^{166}Dy - ^{166}Ho *in vivo* generator; and the synthesis and evaluation of ^{188}Re , ^{186}Re , ^{166}Ho , ^{165}Dy , ^{90}Y , and ^{124}I radiopharmaceuticals will be discussed from the viewpoint of the radiopharmaceutical chemist. The rationales for reactor, cyclotron and generator production, selection of nuclear decay properties to achieve the desired dosimetry, and radionuclide incorporation into candidate ligands will be highlighted. ^{188}Re (16.9 hr.; 764 MeV Beta 100%; 155 KeV gamma 15%) is an ideal nuclide that can be easily separated from ^{188}W (69 d) on alumina or gel columns. There is a focus ^{186}Re and ^{188}Re direct radiolabelling, characterization of aminothiols-Re ligands, and organorhenium complexes. Contemporary topics include: radioimmuno-

therapeutic pharmaceuticals; ^{166}Ho -microspheres, ^{188}Re or ^{90}Y Lipiodol or SMACS proposed for treatment of hepatic carcinoma; relief of pain resulting from metastatic disease to bone (^{186}Re , ^{89}Sr , $^{117\text{m}}\text{Sn}$); radiation synovectomy (^{165}Dy , ^{166}Ho); bone marrow ablation in multiple myeloma (^{166}Ho , ^{153}Sm); radiolabelled anti-sense oligonucleotides relative to gene therapy; and PET with ^{124}I for quantitative measure of a patient's tumor uptake and pharmacokinetic response to facilitate decisions on individualized radiotherapeutic treatment planning with ^{131}I . Factors such as uptake by tumors, *in vivo* targeting and pre-targeting, pharmacodynamics, and treatment planning are overcome by the choice of radionuclides in appropriate carrier molecules that can deliver a high localized absorbed radiation dose, and that also decay with radiation suitable for imaging by SPECT or PET.