

9) Medical Application of Radioactive Compounds (1)

Therapy
destruction of (cancer) cells

Diagnostics
Imaging of organs

- short range
- high dose
- strongly ionising radiation
- β^- - emitter
- α - emitter

- medium range
- low dose
- γ - emitter
- β^+ - emitter

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9) Nuclearmedical Therapy (2)

Therapy
destruction of (cancer) cells

- short range
- high dose
- strongly ionising radiation
- β^- - emitter
- α - emitter

Problem
Partially high radiations dose to
the rest of the organism

β^- - emitter		
Isotope	$t_{1/2}$ (d)	Energy (E_{max} , MeV)
³² P	14,3	1,71
⁴⁷ Sc	3,4	0,6
⁶⁴ Cu	0,5	0,57
⁸⁹ Sr	50,5	1,46
⁹⁰ Y	2,7	2,27
¹⁰² Rh	1,5	0,57
¹¹¹ Ag	7,5	1,05
¹³¹ I	8,0	0,81
¹⁵³ Sm	1,9	0,8
¹⁸⁶ Re	3,8	1,07

α - emitter		
Isotope	$t_{1/2}$ (d)	Energy (E_{max} , MeV)
²¹¹ At	7,2 h	6,8
²¹² Bi	1,0 h	7,8

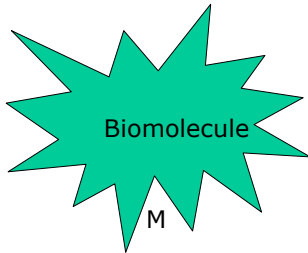
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9) Nuclearmedical Therapy (3)

Principal Procedures

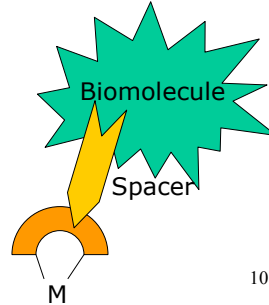
Direct Labeling

- Labeling of a tumor-seeking molecule (e.g. antibody) with a highly ionising radionuclide
- Use of ^{131}I or radioactive metals



Bioconjugate Approach

- Encapsulating of a radionuclide with the help of a chelator and coupling on a biomolecule



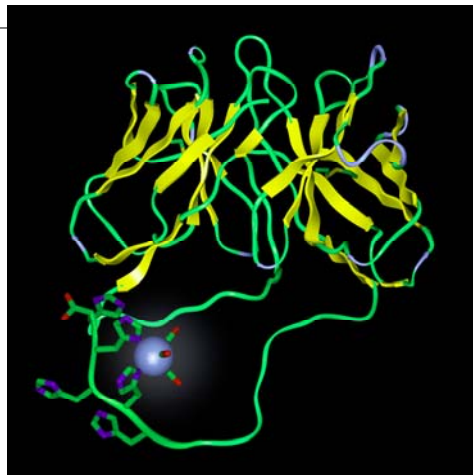
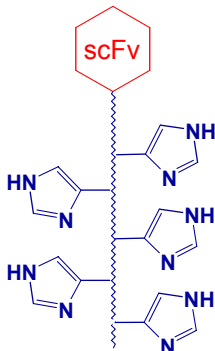
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9) Nuclearmedical Therapy (4)

Principal Procedure

Direct labeling of a tumor-seeking molecule (e.g. antibody) with a highly ionising radionuclide (e.g. ^{186}Re or ^{188}Re)

Example: Binding of a $\{\text{Re}(\text{CO})_3\}^+$ centre to a his-tag of an anti-body



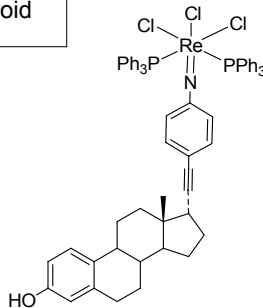
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9) Nuclearmedical Therapy (5)

Alternate therapeutic approach

Complexation of a highly ionising radionuclide (e.g. ^{186}Re or ^{188}Re) with a good chelator (e.g. a multidentate ligand system) and coupling of the whole system to a bioactive molecule

Example: Coupling of a rhenium phenylimido complex to a steroid



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9) Nuclearmedical Therapy (6)

Special Approach - Neutron Capturing Therapy

- Application of (nonradioactive) boron compounds that accumulate in tumor tissue
- Irradiation of the patient (after distribution of the boron compound) with neutrons
- Production of destructive radioactivity direct in the tumor

Special Approach - Palliative treatment of cancer and arthritis

- Application of the radioactive material direct into located tissues
- Use of strong β^- - or α -emitters

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