

AQA Physics A Level

10.6 Radionuclide imaging and therapy

Flashcards

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What is a medical tracer?



What is a medical tracer?

A radioactive substance used to show organ/tissue function, usually a gamma emitting radioisotope bound to a metabolite like water or glucose, the movement of the tracer is mapped and used to form images.



Name 3 gamma-emitting medical tracers



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Medical Tracer	Where it is used in body	Radiation emitted	Half life	Energy of gamma radiation/ keV
Iodine-131	thyroid	Beta and gamma	8days	360
Technetium-99m	Range of organs	gamma	6 hours	140
Indium-111	Antibodies and blood	gamma	2.8 days	170 or 250

Each tracer is picked to go to a particular organ e.g. the thyroid gland naturally uses iodine



State the equation that links effective half life with physical and biological half life.



State the equation that links effective half life with physical and biological half life

$$1/T_E = 1/T_B + 1/T_P$$

T_E : effective half life, s

T_B : biological half life (rate at which body excretes substance), s

T_P : Physical half life (depends on decay constant), s



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Technetium-99m's physical half life is too short to be practically transported, how do hospitals overcome this problem?

Molybdenum-technetium generators, molybdenum has a 66 hour half life so is better for transport, within the generator aluminium oxide is bonded strongly to molybdenum, molybdenum decays to technetium-99m which doesn't bond as strongly so can be washed out with saline solution and used as a tracer.



What are the 5 main parts of a gamma camera and their functions?



What are the 5 main parts of a gamma camera and their functions?

- Lead shield - stops other radioactive sources entering camera
- Lead collimator - lead with vertical holes so only gamma rays parallel to holes can go through
- Sodium iodide crystal - scintillates when gamma ray hits it
- Photomultiplier tubes - converts light from scintillator to electric current as electrons released from photocathode in each tube when light is incident via photoelectric effect
- Circuit - collects signals and sends them to computer



How do positron emission tomography (PET) scans work?



How do positron emission tomography (PET) scans work?

- Inject patient with metabolite containing positron emitting radiotracer with short half life.
- Positrons emitted collide with electrons in organs and annihilate to form gamma ray photons.
- Gamma ray detectors record the emission and a computer builds a map of the emissions.



What are the advantages and disadvantages of PET scans?



What are the advantages and disadvantages of PET scans?

- Radioactivity distribution shows metabolic activity.
- Brain activity can be seen.
- Can monitor spreading of tumours.
- Ionising radiation can damage cells.
- Machine is expensive and large.



How can radiation be used in treating cancer?



How can radiation be used in treating cancer?

- Carefully focused X-ray beams (ionising radiation) are rotated around patient so they damage tumours with minimal damage to healthy tissue.
- Implants with beta emitters placed inside/beside tumour to damage it by ionisation.

