Radioactive medical tracers

Are *radioactive materials* combined with a *carrier drug* injected into the patient's body and carried around the boy by blood. They are usually gamma sources, for example technetium-99m (as alpha and beta particles are absorbed by the patient's body), or a positron source that also creates gamma rays when annihilation occurs with electrons from patient's body. The carrier drug is chosen to assimilate in the part of the body whose **function** we want to examine.

The gamma camera

Consists of three parts.

- **A collimating block of lead** with tens of thousands of holes that allow gamma rays to pass in only one direction, absorbing those at any other angles.
- **A large crystal of sodium iodide** that produces a tiny flash of light when it absorbs a gamma ray.
- **An array of photomultiplier tubes** connected to a computer that amplify the tiny flash of light and detect it.

The computer combines the signals from the photomultipliers and produces a false image.

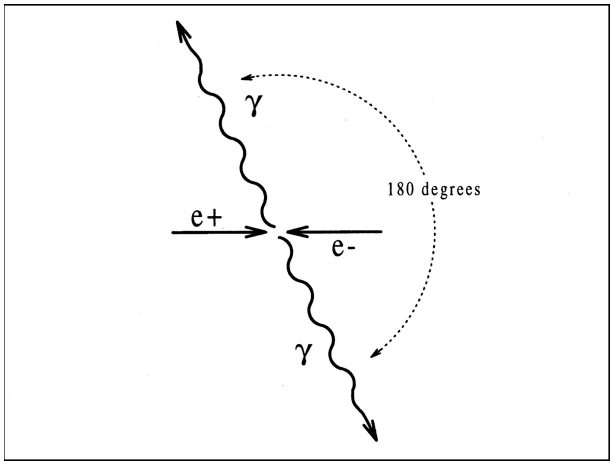
Note: A gamma camera is used to study the **function** of an organ, not its shape.

Uses:

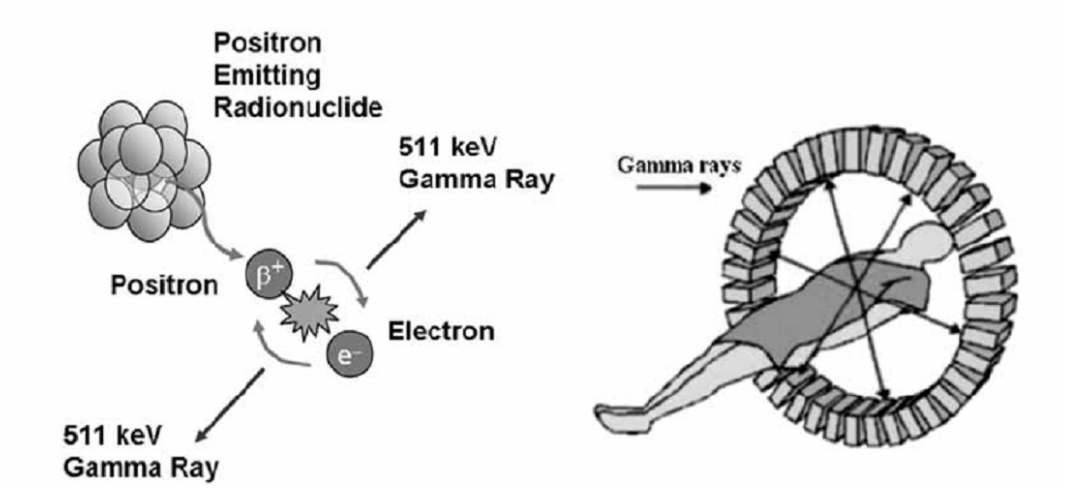
- Detect cancer in bone.
  How? Cancer cells absorb a lot of the tracer and thus show up as bright spots in the image.
- Detect if a kidney is not working well.
  How? If a kidney is not working properly, it will not cleanse the blood of unwanted chemicals including the tracer, and thus shows up brighter than a healthy kidney.

PET (Positron Emission Tomography)

- A positron-emitter radio tracer is injected into the patients bloodstream and is carried around the body by blood.
- Positrons combine withe with ordinary electrons in patient's body. Annihilation take place and two gamma rays are created which travel in opposite directions.



- A ring of detectors surround the patient's body.
- When two detectors receive gamma photos simultaneously or within a very short time, it is very likely that e+/e- annihilation took place along a line joining the two detectors.



- Signals from the detectors is analysed by a computer program that produces a false image of a slice of the body (called a tomograph).

Note: A PET scan, like a gamma camera, is used to study the **function** of an organ, not its shape.

Uses:

- Imaging of the brain for various activities.

How? We use glucose as the *carrier drug*. Parts of the brain that are more active consume more glucose, produce more gamma rays and thus appear brighter.

- Diagnosis of cancer.

How? An area of abnormally high activity that appears brighter on the scan might be suspected to be a fast-growing malignancy, namely cancer.