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1. **Radioactive Tracers**

Radioactive Tracer is a chemical compound in which one or more atoms have been replaced by a radionuclide so by virtue of its radioactive decay it can be used to explore the mechanism of chemical reactions by tracing the path that the radioisotope follows from reactants to products. It can also be used to track the distribution of a substance within a natural system such as a cell or tissue, or as a flow tracer to track fluid flow.

1. **Application in medicine**

Positron emission tomography (PET)

PET technique uses radioactive materials (also known as a tracer or radio-tracer) for imaging, it is generally categorized within the field of nuclear medicine. A tracer is injected into the body, which gets trapped within the tissues of interest. The unstable nucleus of radio-ligand emit positrons, which combine with neighbouring electrons to produce gamma rays in the opposite direction at 180 degrees to each other. These gamma rays are detected by the ring of detector placed within the donut-shaped body of the scanner. The energy and location of these gamma rays are recorded and used by a computer program to reconstruct three-dimensional (3D) images of tracer concentration within the body.

In modern PET computed tomography scanners, PET images are often reconstructed with the aid of a computed tomography X-ray scan performed on the patient during the same session, in the same machine. Different tracers are used for various imaging purposes, depending on the target process within the body. For example, [18F]FDG is commonly used to detect cancer, [18F]NaF is widely used for detecting bone formation, and 15OH2O is used to measure blood flow.

Fluorodeoxyglucose (FDG) is an analogue of glucose and the most commonly used tracer molecule for PET. The concentrations of imaged FDG tracer indicate tissue metabolic activity as it corresponds to the regional glucose uptake. Metabolic trapping of the radioactive glucose molecule allows the PET scan to be utilized. FDG is used to explore the possibility of cancer spreading to other body sites (cancer metastasis). These FDG-PET scans for detecting cancer metastasis are the most common in standard medical care (representing 90% of current scans). The same tracer may also be used for the diagnosis of types of dementia. Less often, other radioactive tracers, usually but not always labelled with fluorine-18, are used to image the tissue concentration of different kinds of molecules of interest inside the body.