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**MLS 314(MEDICAL PHYSICS)**

1. **What are radioactive tracers?**
2. **Discuss explicitly one application of tracer in Medicine.**

**ANSWERS**

1. **Radioactive tracers** are chemical compounds in which one or more atoms have been replaced by a radioisotope. Monitoring its radioactive decay, a radiotracer can be used to explore the mechanism of chemical reactions . They are also used for flow visualisation through different technologies, such as Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET) and Computed Radioactive Particle Tracking (CARPT).

Radioactive tracers can also be used to track the distribution of a substance within a natural system such as a cell or tissue as a flow tracer to track fluid flow. Radioactive tracers are also used to determine the location of fractures created by hydraulic fracturing in natural gas production.Approved tracers are called radiopharmaceuticals since they must meet FDA’s exacting standards for safety and appropriate performance for the approved clinical use.

1. **Nuclear medicine** is a medical specialty that uses radioactive tracers (radiopharmaceuticals) to assess bodily functions and to diagnose and treat disease. Specially designed cameras allow doctors to track the path of these radioactive tracers. Single Photon Emission Computed Tomography or SPECT and Positron Emission Tomography or PET scans are the two most common imaging modalities in nuclear medicine.

**Positron Emission Tomography (PET**)

Positron emission tomography (PET) is an imaging technique that uses radioactive substances to visualize and measure metabolic processes in the body. PET is mainly used in the area of medical imaging for detecting or measuring changes in physiological activities like metabolism, blood flow, regional chemical composition, and absorption, and therefore, also called a functional imaging technique.

A PET scans also use radiopharmaceuticals to create three-dimensional images. The main difference between Single Photon Emission Computed Tomography (SPECT) and PET scans is the type of radiotracers used. While SPECT scans measure gamma rays, the decay of the radiotracers used with PET scans produce small particles called positrons. A positron is a particle with roughly the same mass as an electron but oppositely charged. These react with electrons in the body and when these two particles combine they annihilate each other. This annihilation produces a small amount of energy in the form of two photons that shoot off in opposite directions. The detectors in the PET scanner measure these photons and use this information to create images of internal organs.

USES

PET is both a medical and research tool used in pre-clinical and clinical settings. It is used heavily in the imaging of tumours and the search for metastases within the field of clinical oncology, and for the clinical diagnosis of certain diffuse brain diseases such as those causing various types of dementias. PET is a valuable research tool to learn and enhance our knowledge of the normal human brain, heart function, and support drug development. PET is also used in pre-clinical studies using animals. It allows repeated investigations into the same subjects over time, where subjects can act as their own control and substantially reduces the numbers of animals required for a given study. This approach allows research studies to reduce the sample size needed while increasing the statistical quality of its results.