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1. **WHAT ARE RADIOACTIVE TRACERS?**

Radioactive Tracers are synthetic chemical compounds consisting of an endogenous or exogenous carrier molecules that partakes in human metabolism and in which one or more atoms have been replaced by radio isotope through which it’s natural decay allows for imaging of the compounds. They are generally short-lived isotopes linked to chemical compounds which permit specific physiological processes to be scrutinized. Radioactive tracers adsorb not only on solid container surface and precipitates but on any kind of solid materials { Dust, Cellulose, Fibers, Glass fragments, Organic Materials} suspended or in contact with the solution. If the solution contains large molecules such as Polymeric metals hydrolysis products, these also tend to adsorb trace element. They can given by injection, inhalation or orally. They emit a signal, usually gamma rays that can be identified.

Radioactive tracers utilize the positive qualities of radioactivity, the ability to emit a signal, while minimizing the negative effects. Isotopes use elements with a short half-life to reduce the dangers of radioactive exposure to the patient. A half-life represents the amount of time taken for one-half of the substances radioactivity to decay.

**Materials**

The most common radioactive isotopes used in radioactive tracers is Technetium-99m used in almost 30 million procedures in 2008. It is an isotope of artificial element; Technetium with a half-life of 6 hours which provides enough time to perform the necessary diagnostic procedures, but provides patient’s safety. It is versatile and can be targeted to a specific organ or body parts and emits gamma rays that provide the necessary information. Examples of other radioactive tracers includes: Iodine 131 for thyroid conditions, Iron-59 Iron to study metabolism in the spleen and potassium in the blood.

**Principles of Radioactive Tracers.**

The principle states that Radioactive Isotopes have the same chemical properties as non-radioactive isotope of the same element. Isotopes of the same element differs only in the number of neutrons in their atoms, which leads to nuclei with different stabilities. Unstable nuclei gain stability by radioactive decay which leads to different types of radioactivity.

**Advantages of a Radioactive Tracers.**

1. **Safe:** A radioactive tracer is used to detect and image a tissue, not affect them with radiation, hence it uses only small amounts of radioactive materials. As no other processes in the human body produces gamma radiation, the energy produced by the tracer stands out clearly, even in small quantities. Chemists select radioactive materials that decay in a matter of hours or days, reverting to a normal state and posing no-long term problems.
2. **Metabolic Tracking:** The tracer’s progress can be followed as the body metabolizes it. Organs break down and combine chemical compounds through a long chain of biological processes. If the right atoms of the compound are radioactive, the doctor can see if the tracer stops in certain parts of the body or if it passes on to other tissues and organs.
3. **Specific:** A chemist can design and synthesize radioactive compounds specifically suited for a particular organ, tissues and biological processes. These compounds are radioactive version of biological substances known to collect in certain tissues. Chemically and biologically, the tracer acts the same as a non-radioactive compounds, though it gives a detectable radiation.
4. **Non-invasive:** A physician can examine the state ID a patient’s organs without performing surgery or getting a biopsy using a radioactive tracers. The tracer collects in the tissues and emits gamma rays radiation. Detectors produce detailed images of the affected organs by measuring the radiation. Combining these images with those from the Computed Tomography Scans results in a detailed picture with specific areas highlights the tracer.

**Disadvantages of a Radioactive Tracers.**

1. The patient has to be placed in isolation for a while until all radiation leaves the body.
2. It is hazardous to patients — radiation can ionise cells.
3. The radiation used for the tracer has to be stored safely.
4. The radiation used has a short half-life hence, needs to be used quickly.
5. **APPLICATION OF TRACERS IN MEDICINE.**

In medicine, tracers are applied in a number of tests, such as Technetium-99m in autoradiography and nuclear medicine, including Single Photon Emission Computed Tomography {SPECT}, Positron Emission Tomography {PET} and Scintigraphy.

Nuclear Medicine uses radiation to provide information about the functioning of a person’s specific organs or to treat disease. The information is used by physician to make a quick diagnosis of the patient’s illness. The radiation is used to treat diseased organs or tumors. If a person is ingested with the element iodine for example, the iodine goes largely to the thyroid glands located at the base of the throat and the iodine is used in the production of various hormones or chemical messengers that controls essential body functions such as the rate of metabolism. If the person’s thyroid gland is suspected not to function properly, the person is given a glass of water containing sodium iodide. The iodine in the sodium iodide is a radioactive and as the person’s body takes up the sodium iodide, the path of the compound through the body can be traced by means of Geiger Counter or some other detection device.

A major use of radioactive tracers involves computed X-ray Tomography or CT scans. These scans constitute approximately 75% of medical procedures with tracers. The radioactive tracers produces gamma rays or single photons that a gamma camera detects. Emission comes from different angles and the computer uses them to produce an image. Therapeutic applications of radioisotopes are also intended to destroy the targeted cells. This approach forms the basis of Radiotherapy, which is commonly used to treat cancer and other conditions involving abnormal tissue growth, such as *Hyperthyroidism.* In radiation therapy for cancer, the patient’s tumor is bombarded with ionizing radiation typically in form of beams of subatomic particles, such as proton, neutrons or alpha or beta particles, which directly disrupt the atomic or molecular structure of the targeted tissue. Ionizing radiation introduces breaks in the double stranded DNA molecule, causing the caner cells to die and thereby preventing their reputation. Radioactive tracers are also used to study lipoprotein metabolism in human and experimental animals.