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16/MHS06/004

MEDICAL LABORATORY SCIENCE

MEDICAL PHYSICS

ASSIGNMENT:What are radioactive tracers?

Discuss explicitly one application of tracer in Medicine.

Answer:

1:What are radioactive tracers?:

RADIOACTIVE TRACER'S:

radioactive tracer, radiotracer, or radioactive label, is a chemical compound in which one or more atoms have been replaced by a radionuclide so by virtue of its radioactive decay it can be used to explore the mechanism of chemical reactions by tracing the path that the radioisotope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. Radiolabeling or radiotracing is thus the radioactive form of isotopic labeling.

Radioisotopes of hydrogen, carbon, phosphorus, sulfur, and iodine have been used extensively to trace the path of biochemical reactions. A radioactive tracer can also be used to track the distribution of a substance within a natural system such as a cell or tissue,[1] or 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.[2] Radioactive tracers form the basis of a variety of imaging systems, such as, PET scans, SPECT scans and technetium scans. Radiocarbon dating uses the naturally occurring carbon-14 isotope as an isotopic label.

Production:

The commonly used radioisotopes have short half lives and so do not occur in nature. They are produced by nuclear reactions. One of the most important processes is absorption of a neutron by an atomic nucleus, in which the mass number of the element concerned increases by 1 for each neutron absorbed.

TRACER ISOTOPES:

Hydrogen

Carbon

Iodine

Sulphur

Phosphorus

Fluorine

Oxygen

Nitrogen.

Tritium.

Application:In metabolism research, Tritium and 14C- glucose are commonly used in glucose clamps to measure rates of glucose uptake, fatty acid synthesis, and other metabolic processes.[9] While radioactive tracers are sometimes still used in human studies, stable isotope tracers such as 13C are more commonly used in current human clamp studies. Radioactive tracers are also used to study lipoprotein metabolism in humans and experimental animals.[10]

In medicine, tracers are applied in a number of tests, such as 99mTc in autoradiography and nuclear medicine, including single photon emission computed tomography (SPECT), positron emission tomography (PET) and scintigraphy. The urea breath test for helicobacter pylori commonly used a dose of 14C labeled urea to detect h. pylori infection. If the labeled urea was metabolized by h. pylori in the stomach, the patient's breath would contain labeled carbon dioxide. In recent years, the use of substances enriched in the non-radioactive isotope 13C has become the preferred method, avoiding patient exposure to radioactivity.[11]

In hydraulic fracturing, radioactive tracer isotopes are injected with hydraulic fracturing fluid to determine the injection profile and location of created fractures.[2] Tracers with different half-lives are used for each stage of hydraulic fracturing.

2:Discuss explicitly one application of tracer in Medicine.

APPLICATION OF TRACER IN MEDICINE:

Medical tracers

Radioactive isotopes and radioactively labelled molecules are used as tracers to identify abnormal bodily processes. This is possible because some elements tend to concentrate (in compound form) in certain parts of the body – iodine in the thyroid, phosphorus in the bones and potassium in the muscles. When a patient is injected with a compound doped with a radioactive element, a special camera can take pictures of the internal workings of the organ. Analysis of these pictures by a specialist doctor allows a diagnosis to be made.

The thyroid gland, situated in the neck, produces a hormone called thyroxine, which regulates the rate of oxygen use by cells and the generation of body heat. Within each molecule of thyroxine, there are 4 iodine atoms. If a patient is made to drink a solution of sodium iodide that has been doped with radioactive iodine-131, most of it will end up in the thyroid gland. A special camera can capture the radiation emitted by the iodine-131, and an image of the gland can be constructed. An assessment can then be made about the shape, size and functioning of the gland.

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