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 A radioactive tracer, radiotracer, or radioactive label, is a chemical compound in which one or more atoms have been replaced by a radionuclide so by virtue of its radioactive decay it can be used to explore the mechanism of chemical reactions by tracing the path that the radioisotope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

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.

The principle behind the use of radioactive tracers is that an atom in a chemical compound is replaced by another atom, of the same chemical element. The substituting atom, however, is a radioactive isotope. This process is often called radioactive labeling. The power of the technique is due to the fact that radioactive decay is much more energetic than chemical reactions. Therefore, the radioactive isotope can be present in low concentration and its presence detected by sensitive radiation detectors such as Geiger counters and scintillation counters.

**There are two main ways in which radioactive tracers are used**

1. When a labeled chemical compound undergoes chemical reactions one or more of the products will contain the radioactive label. Analysis of what happens to the radioactive isotope provides detailed information on the mechanism of the chemical reaction.
2. A radioactive compound is introduced into a living organism and the radio-isotope provides a means to construct an image showing the way in which that compound and its reaction products are distributed around the organism.

Radioisotopes of hydrogen, carbon, phosphorus, sulfur, and iodine have been used extensively to trace the path of biochemical reactions.

1. **APPLICATION OF TRACER IN MEDICINE**

* Radiotherapy can be used to treat some medical conditions, especially cancer, using radiation to weaken or destroy particular targeted cells.

Internal radiotherapy is treatment with a radioactive material that is put inside the body to treat cancer. There are different types of internal radiotherapy.

* brachytherapy
* radioisotope or radionuclide therapy
* selective internal radiation therapy (SIRT).

**Brachytherapy**

**Brachytherapy** uses radioactive implants such as seeds, pellets, wires or plates that are put near or inside the tumour. The radioactivity only affects tissue that is very close to the implant. This means the tumour is treated, but healthy areas around it get much less radiotherapy. Areas of the body that are further away are not affected at all. The implants are left in place to give the correct dose of treatment. Depending on the type of brachytherapy, this may take a few minutes or a few days. Some types of implants are designed to be left in the body permanently. Your team will explain your treatment plan. This may also involve external beam radiotherapy or other treatments such as chemotherapy, hormonal therapy or targeted therapy.

Brachytherapy is mainly used to treat cancers in the prostate, cervix and womb. It is sometimes used to treat other cancers, such as cancer of the vagina, vulva, oesophagus (gullet), lung, rectum and eye.

**Radioisotope therapy**

Radioisotope therapy uses radioactive liquid (known as radioisotopes or radionuclides) to destroy cancer cells.

The liquid can be given:

by mouth as a drink or capsules

as an injection into a vein.

Cancer cells take in the radioisotope more than normal cells do. This means they get a higher dose of radioactivity. This eventually destroys the cancer cells.

**Types of radioisotope therapy**

**Iodine-131**

This is the most common type of radioisotope therapy. It is mainly used to treat some types of thyroid cancer. It may also be used to treat other rarer neuroendocrine tumours. You usually have it as capsules or a drink. But it can also be given as an injection into a vein in the arm. You may have to stay in hospital to have this treatment.

**Strontium-89 and Samarium-153**

These radioisotopes can be used to treat some types of cancer that have spread to the bones (metastatic bone cancer). This treatment can help reduce bone pain and improve quality of life. You can usually go home soon after having this treatment.

**Radium-223**

This radioisotope is sometimes used to treat prostate cancer that has spread to the bones. It may be used if hormone therapy alone is no longer controlling the cancer. You can usually go home soon after having this treatment.

**Selective internal radiation therapy (SIRT)**

Selective internal radiation therapy (SIRT) is a type of internal radiotherapy that uses radioactive beads. It is used to treat some types of liver cancer. For example, it may be used to treat cancer that spreads to the liver from the bowel.

SIRT is not widely available and is not always funded by the NHS. You may have it as part of a research trial. SIRT is also called radioembolisation.

Possible side effects of SIRT are:

. There may be bruising or a small lump where the angiogram catheter went into your groin or wrist.

* Feeling sick (nausea)
* Tummy (abdominal) pain
* High temperature (fever)
* Tiredness
* **Changes to the liver**

SIRT can affect normal liver cells. This may cause changes to how the liver works. You will have regular blood tests to check this. Changes usually get better after a few weeks. Rarely, they can get worse after about 4 to 6 weeks.