<u>Radiopharmaceuticals: Cancer Therapy</u>

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Week 1

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AIM

The aim of this is paper is to make aware the reader about the technologies that exists that make the treatment of certain diseases such as cancer to be more efficient by the use of different approaches. In this particular case, we'll look into the dealings in regards to the radioactive substances and the science behind them that is being applied to treat diseases such as cancer. Radiopharmaceuticals, or medicinal radio compounds, are a group of pharmaceutical drugs containing radioactive isotopes. Radiopharmaceuticals can be used as diagnostic and therapeutic agents. Radiopharmaceuticals emit radiation themselves, which is different from contrast media which absorb or alter external electromagnetism or ultrasound. Radiopharmacology is the branch of pharmacology that specializes in these agents. The main group of these compounds are the radiotracers used to diagnose dysfunction in body tissues. While not all medical isotopes are radioactive, radiopharmaceuticals are the oldest and still most common such drugs. Radiation therapy was first used to treat cancer more than 100 years ago. About half of all cancer patients still receive it at some point during their treatment. And until recently, most radiation therapy was given much as it was 100 years ago, by delivering beams of radiation from outside the body to kill tumors inside the body.

Week 1

Delivering radiation directly to cells isn't itself a new approach. One such therapy, called radioactive iodine, has been used to treat some types of thyroid cancer since the 1940s. Iodine naturally accumulates in thyroid cells. A radioactive version of the element can be produced in the lab. When ingested (as a pill or a liquid), it accumulates in and kills cancer cells left over after thyroid surgery.

A similar natural affinity was later exploited to develop drugs to treat cancer that has spread to the bones, such as radium 223 dichloride, which was approved in 2013 to treat metastatic prostate cancer. When cancer cells grow in the bone, they cause the bone tissue they invade to break down. The body then attempts to repair this damage by replacing that bone—a process called bone turnover. The radioactive element radium "looks like a calcium molecule, so it gets incorporated into areas of the body where bone turnover is highest," such as areas where cancer is growing. The radium is then able to kill nearby cancer cells. These radioactive compounds all travel to cancer cells without any help. Researchers wondered whether it would be possible to engineer new radioactive molecules that specifically target other cancers.

Radiopharmaceuticals can be divided into four categories:

Radiopharmaceutical preparation A radiopharmaceutical preparation is a medicinal product in a ready-to-use form suitable for human use that contains a radionuclide. The radionuclide is integral to the medicinal application of the preparation, making it appropriate for one or more diagnostic or therapeutic applications.

Radionuclide generator A system in which a daughter radionuclide (short half-life) is separated by elution or by other means from a parent radionuclide (long half-life) and later used for production of a radiopharmaceutical preparation.

Radiopharmaceutical precursor A radionuclide produced for the radiolabelling process with a resultant radiopharmaceutical preparation.

Kit for radiopharmaceutical preparation In general a vial containing the nonradionuclide components of a radiopharmaceutical preparation , usually in the form of a sterilized, validated product to which the appropriate radionuclide is added or in which the appropriate radionuclide is diluted before medical use. In most cases the kit is a multidose vial and production of the radiopharmaceutical preparation may require additional steps such as boiling, heating, filtration and buffering. Radiopharmaceutical preparations derived from kits are normally intended for use within 12 hours of preparation.