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Department of Biomedical Engineering

Vision Tit 2 Vision Title 3

Course Name: 19BME301 – Medical Physics

III Year : V Semester

CBS1: Radioisotopes in Medicine

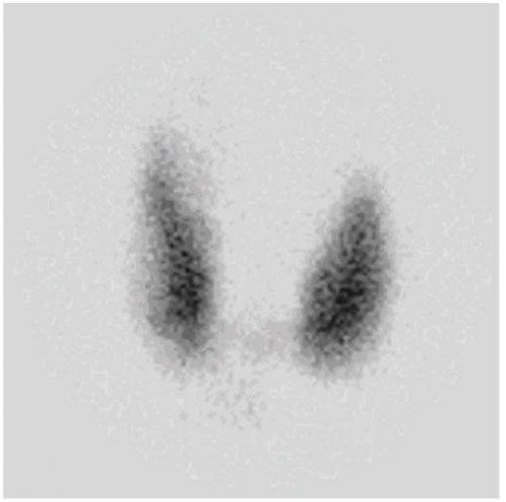
Radioisotopes in Medicine

- **Nuclear radiation can be high-energy particles or high-energy rays.**
- **Some radioisotopes of elements are useful in medical imaging, as they concentrate in particular tissues.**
- **The radiation can create an image on a photographic plate or be detected by scanning sections of the body.**

Medical Applications for Radioisotopes

Medical Applications for Radioisotopes

- **It is important to expose patients to the smallest possible dose of radiation for the shortest time period.**
- **Radioisotopes with short half-lives are selected for use in nuclear medicine.**
- **Iodine is used only by the thyroid gland:**



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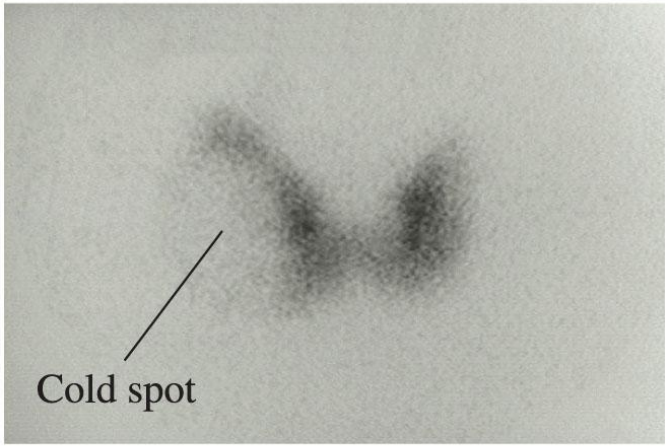

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Medical Applications for Radioisotopes

- **The two main uses of medical radioisotopes**
  - **Diagnosing diseased states**
  - **Therapeutically treating diseased tissues**

- **When diagnosing a diseased state, a minimum amount of radioisotope is administered.**

- **The isotope is for detection only and should have minimal effects on body tissue.**
  - **Radioisotope used this way is a tracer.**

Medical Applications for Radioisotopes

- **Gamma emitters are useful for diagnosis because gamma radiation can easily exit the body**.

- **If tissue is functioning normally, the radioisotope will be evenly distributed throughout the organ.**

- **If there is a nonfunctioning area in the tissue, a "cold" spot is seen.**

- **Unusual activity, like rapidly dividing cancer cells, shows up as a "hot" spot.**

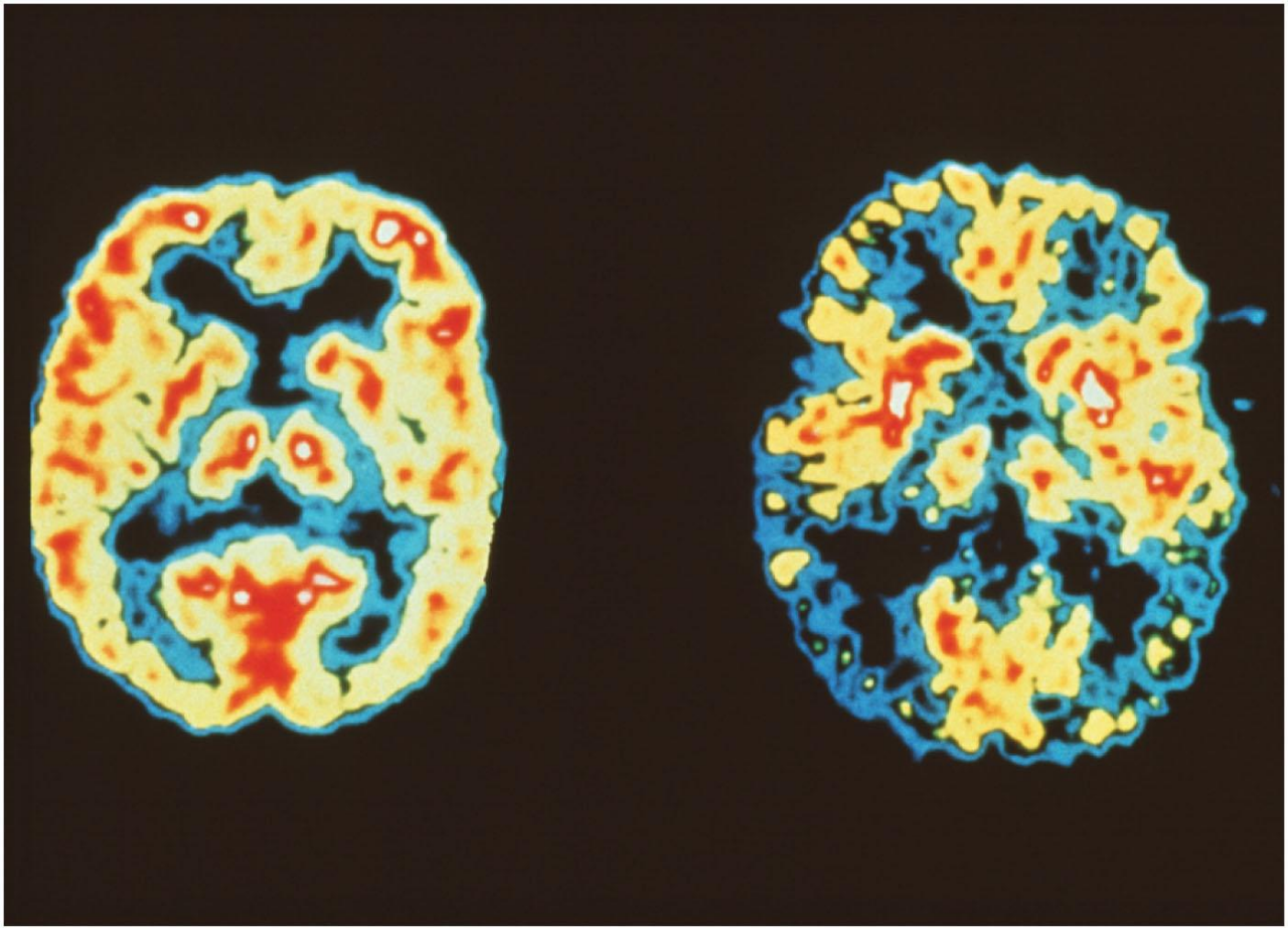
Radioisotopes and Cancer Treatment

- **In *external beam radiation therapy*, gamma radiation generated from cobalt-60 is aimed at a tumor, destroying the tissue.**
- **In *brachytherapy*, small Ti "seeds" containing radioisotopes are implanted in a tumor.**

In brachytherapy, small titanium seeds containing a radioisotope like Pd-103 or I-125 are implanted at the tumor site.

Medical Applications for Radioisotopes

- **Positron Emission Tomography**



Positron Emission Tomography

- **PET scans are used to identify functional abnormalities in organs and tissues.**
- **Fluorine-18 has a half-life of 110 min.**
- **The fluorine isotope emits a positron as it decays to form oxygen-18.**
- **The positron comes into contact with an electron, and gamma radiation is produced and detected by the scanner.**
- **This type of scan is commonly used for the brain.**

Summary

Radioactivity and Radioisotopes

- Some atomic isotopes emit radiation (a form of energy) spontaneously from their nucleus in a process called radioactive decay.
- Isotopes that undergo radioactive decay are called radioisotopes, and the high-energy particles given off in this process are referred to as ionizing radiation, or radioactivity.
- Three common forms of radioactivity are alpha (α) and beta (β) particles and gamma (γ) rays.
- An X-ray is also a form of ionizing radiation, although it is not caused by a radioactive decay event.
- Different forms of ionizing radiation penetrate the body differently, producing different biological effects.

Summary (continued)

Medical Applications for Radioisotopes

- Certain elements concentrate in particular organs of the body.
- If a radioisotope of this element can be made, this area of the body can be imaged using that radioisotope.
- A patient can be injected with a trace amount of a radioisotope to diagnose a diseased state.
- Radioisotopes can also be used to treat diseases.
- Radioisotopes can be applied externally (external beam radiation therapy) or internally (brachytherapy) by applying radiation directly at the tumor site in high doses, eliminating cancerous cells.
- Positron emission tomography (PET) uses a radioisotope to image tissues that are not functioning normally.

Thank You