APPLICATIONS OF RADIOPHARMACEUTICALS

B.PHARMACY 1ST SEMESTER PHARMACEUTICAL INORGANIC CHEMISTRY

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NUCLEAR PHARMACY

- WHERE DO WE START?

- X Rays discovered in 1895
- Artificial radioactivity discovered in 1934
- First clinical use of radioactivity 1937
- Radioactive iodine used succesfully to treat cancer 1946
- Widespread use of nuclear medicine 1950

RADIOPHARMACEUTICALS

Pharmaceuticals are the substances used to diagnose, treat and prevent diseases.

Radiopharmaceuticals are the radioactive pharmaceuticals used in nuclear medicine.

These drugs are made up of two components-

A radioactive isotope and a carrier molecule.

APPLICATIONS

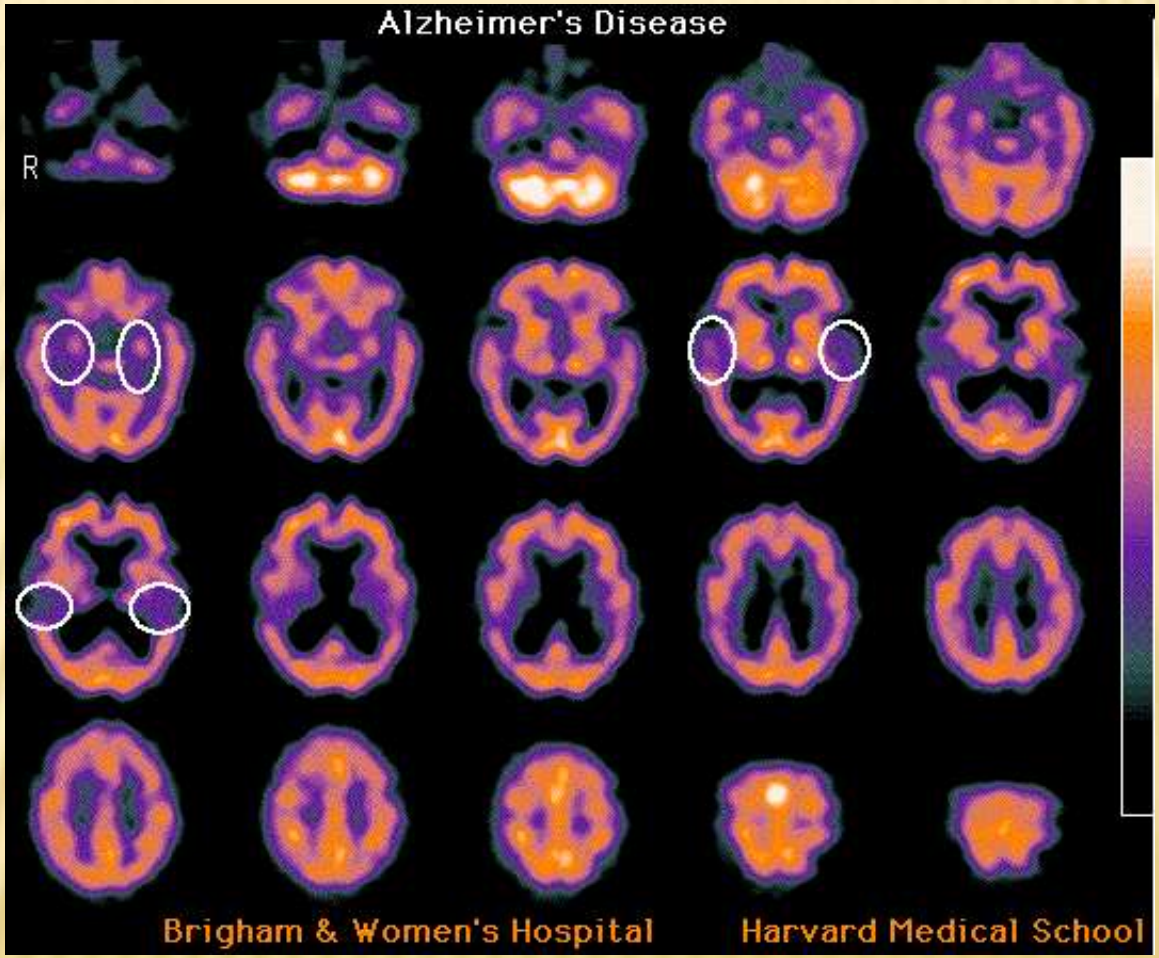
Radioisotopes are used in medicine in four different ways

- Diagnostic
- Therapeutic
- Research
- Sterilization

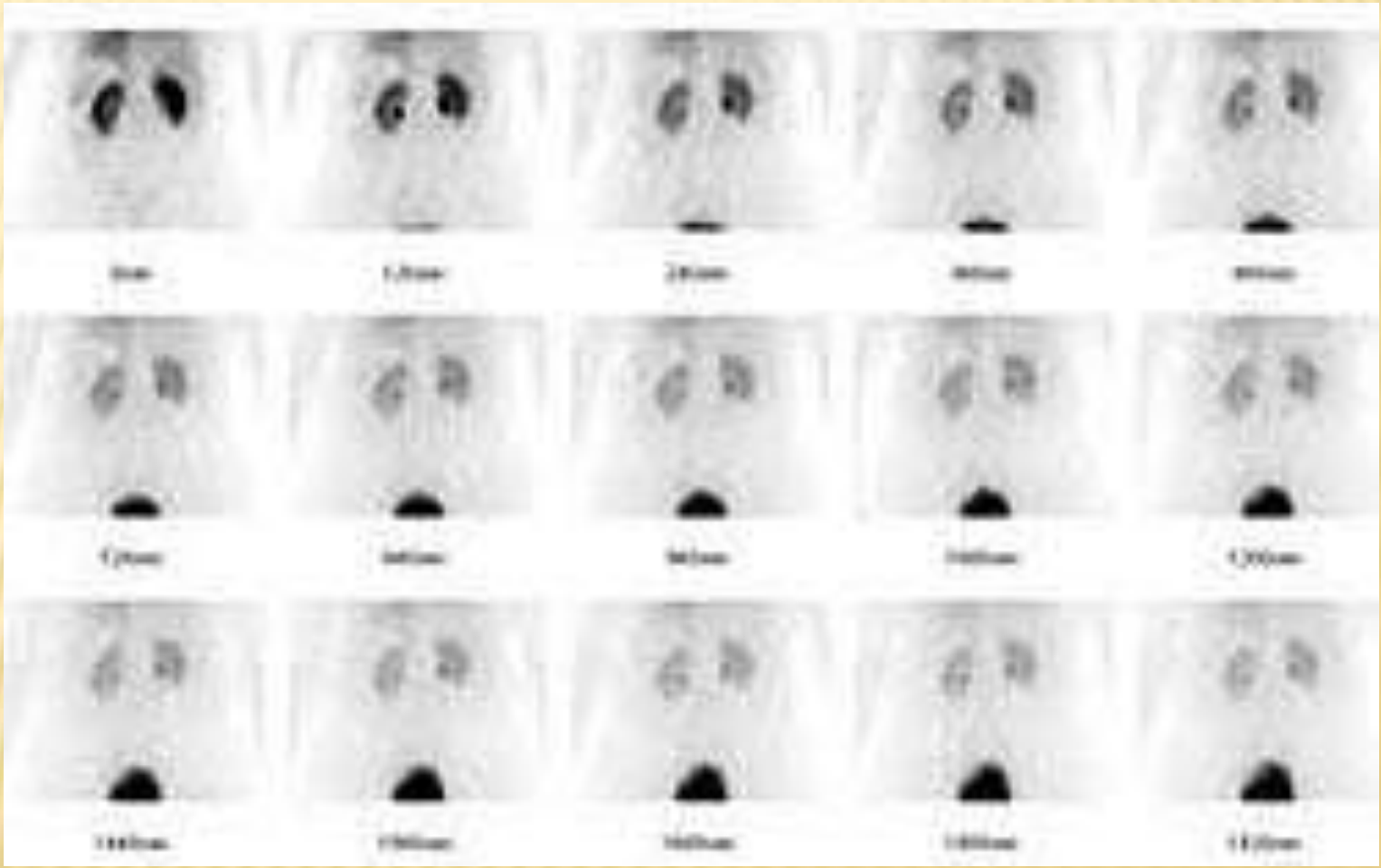
DIAGNOSTIC RADIOPHARMACEUTICALS

- DEFINITION:
- Examples:
- Biliary tract blockage—Technetium Tc
- Bone diseases—Sodium Fluoride F 18, Technetium Tc
- Heart disease—Ammonia N 13,
- Kidney diseases—Iodohippurate Sodium I 123,
- Red blood cell diseases—Sodium Chromate Cr 51

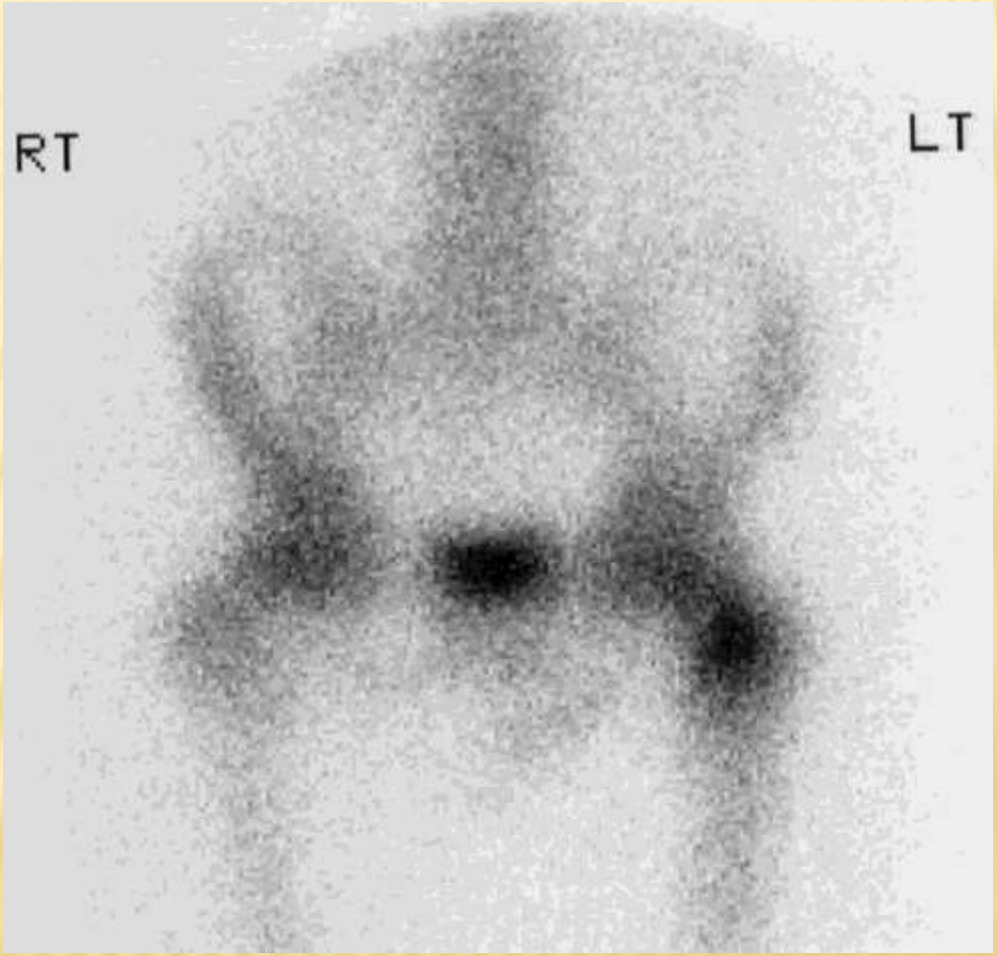
BRAIN SCAN


Alzheimer's Disease
R
Brigham & Women's Hospital
Harvard Medical School

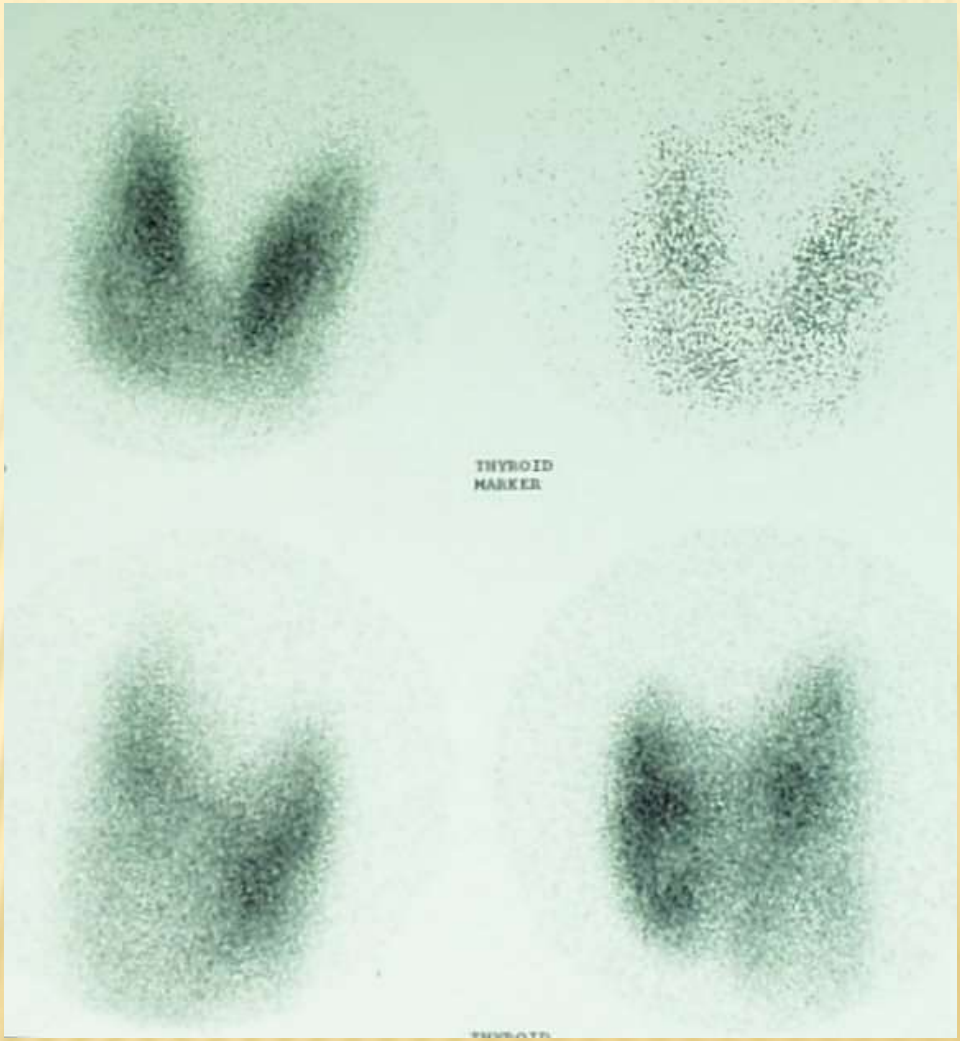
KIDNEY- SODIUM IODOHIPPURATE



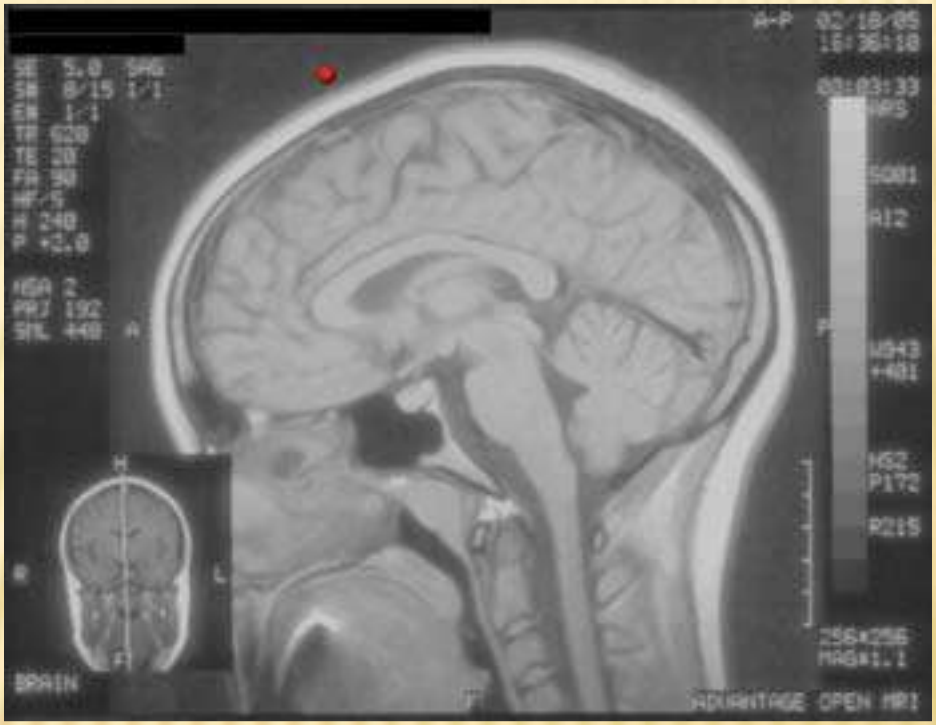
BONE SCAN



THYROID GLAND SCAN



MRI SCAN

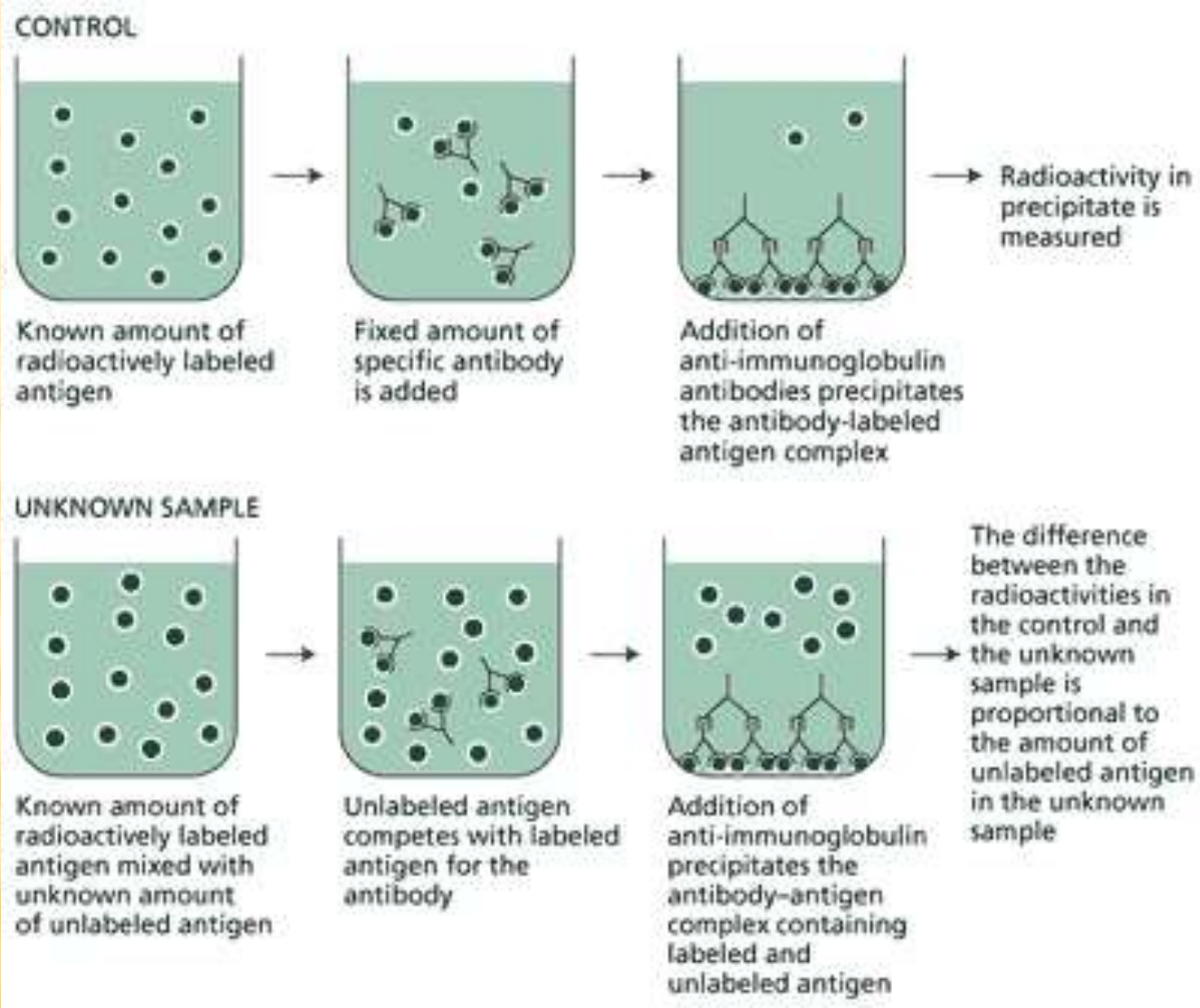


EXAMPLES:

Brain tumors diagnosis:using I 131

Diagnosis of helicobacter pylori: C14

RADIO IMMUNO ASSAY



THERAPEUTIC RADIOPHARMACEUTICALS

- DEFINITION: molecules used to deliver their ionic radiations in therapeutic doses to the diseased sites.

- AIM : Destroy diseased tissues without destroying healthy tissues.

- Divisions of therapy:

∆External

∆Internal

EXTERNAL THERAPY

- α- radiations : poorly penetrating
- β-radiations : weakly penetrating . Used for surface treatment of disorders. ex:eyes
- γ- radiations : highly penetrating . Used for deep seated tumors.

INTERNAL THERAPY

Administration:

Example:

Chromic phosphate P 32 suspension:

Chromic phosphate suspended in 30% dextrose solution is given in the form of injection for the treatment of malignant carcinoma of ovary.

I 131 is used to destroy thyroid cells in case of thyrotoxicosis.

RESEARCH

- Used as tracers for studying biochemical processes.
- Examples:C14, H 3, radio isotopes of Na,Mg,Ca,Cu etc.

STERILISATION:

- Used to sterilise pharmaceuticals in their final packed containers and surgical instruments in hospitals.Thermolabile substances like vitamins, hormones, antibiotics etc can be safely sterilised.
- Example:Co 60, Cesium 137

RADIOPHARMACEUTICAL PREPARATIONS

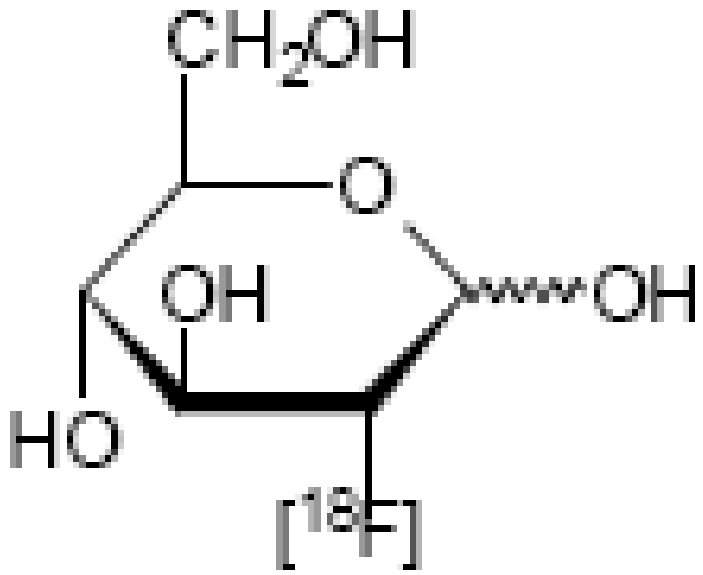
Fludeoxyglucose (18F) injection:

Description: Fludeoxyglucose (18F) injection (18F-FDG) is a colourless or slightly yellow and sterile solution.

Radionuclide production: 18F is a radioisotope of fluorine and may be prepared by proton

irradiation of 18O deuteron irradiation of 20Ne or alpha irradiation of 16O and processed in a manner that 18F obtained is carrier free.

GRAPHIC FORMULA



Category: Diagnostic radiopharmaceutical for liver diseases.

Chemical name. 2-[18F] fluoro-2-deoxy-D-glucopyranose (2-[18F] fluoro-2- deoxy – Dglucose

The radioactive half life of 18F is 109.8 minutes

SODIUM IODIDE (131 I) CAPSULES

- **Description. White or coloured gelatine capsule contained in a sealed secondary container**

The radioactive half-life of

131I is 8.06 days.

production: Complies with 131I production and general conditions in radiopharmaceutical preparation. Iodine-131 may be obtained by neutron irradiation of tellurium or by extraction from uranium fission products.

Radiopharmaceutical formulation: The content of 131I is not less than 90.0% and not more than 110.0% of the stated content on the label at the reference date and hour. The method of manufacture is such that the specific activity used is not less than 185MBq of iodine-131 per mg of iodine for diagnostic capsules and 185MBq of iodine-131 per microgram of iodine for therapeutic capsules.

Category: Diagnostic and therapeutic radiopharmaceutical

TC 99 GENERATOR

SODIUM PHOSPHATE (32P) INJECTION

Description: A clear, colourless sterile solution containing radioactive disodium and monosodium (32P) orthophosphate made isotonic to blood with sodium chloride.

Radionuclide production: 32P is radioactive isotope of phosphorous and may be produced by neutron irradiation of sulfur. The radioactive half-life of 32P is 14.3 days

Category: Therapeutic radiopharmaceutical.

PHAMACOPOEIAL PRERERATIONS:

- Fludeoxyglucose (18F) injection.
- Gallium Citrate (67Ga) injection
- Sodium Phosphate (32P) injection
- Strontium Chloride (89Sr) injection
- Technetium (99mTc) labelled Red Blood Cells injection
- Technetium (99mTc) Sulphur Colloid injection

THANKS