RADIOPHARMACEUTICALS, RADIO PHARMACY, AND NUCLEAR PHARMACY

Radiopharmaceuticals

Radiopharmaceuticals are medicinal products formed from the combination of two words: **radioactive** and **pharmaceuticals**. They contain **two essential components**:

1. **Radiotracer**
    - Present in very small (minute) quantities
    - Does **not** produce any pharmacological effect
    - Helps in targeting specific organs or tissues
2. **Radionuclide**
    - The radioactive component of the radiopharmaceutical
    - It is an unstable element with a specific atomic number
    - Responsible for emitting radiation

Radio pharmacy

Radiopharmacy is the specialized service or unit where radiopharmaceuticals are prepared and dispensed.

- Also called a **hot laboratory** due to the handling of radioactive materials.
- Managed by a **radiopharmacist**, who is trained in:
    - Research methodology
    - Modes of radioactive decay
    - Radiopharmaceutical technology and quality control
    - Structure of matter and radiation safety

Nuclear Pharmacy

Nuclear pharmacy is a specialized branch of hospital pharmacy focused on using radioactive drugs for **diagnosis** and **therapy**.
Services provided include:

- Procurement and storage of radiopharmaceuticals
- Compounding and dispensing
- Quality control testing
- Safe distribution and transport
- Patient monitoring and documentation
- Research and development

Overview of Radiopharmaceuticals

Radiopharmaceuticals (also called radioisotopes or radionuclides) emit radiation due to unstable isotopes.
This property is termed **radioactivity**, and the isotopes are known as **radioactive isotopes**.

Examples:

- **Uranium-238:** Common radioactive isotope.
- **Cobalt-60:** Emits high-energy gamma rays, used to destroy cancer cells.
- **Gallium isotopes:** Used for diagnostic scans and other therapeutic purposes.

Mechanism of Action

Radiopharmaceuticals are administered by **injection, oral ingestion, or inhalation** in very small amounts.

- The pharmaceutical part targets specific organs or disease sites.
- The radionuclide emits gamma rays.
- **Gamma cameras** detect these emissions, producing images that help physicians diagnose internal abnormalities.

During imaging:

- The patient lies on a table.
- Gamma camera captures images over several minutes.
- Results are used for accurate diagnosis.

Packing of Radiopharmaceuticals

Industrial Packing

- Used for low-level radioactive substances (e.g., slightly contaminated lab samples, clothing, smoke detectors).
- Minimal radiation hazard.

Type A Packing

- Used for **medical and diagnostic purposes**.
- Includes sources like brachytherapy seeds, nucleonic gauge sources, and diagnostic tracers.
- Regulated by limits on maximum activity (A1 – special form, A2 – non-special form).

Type C Packing

- Used for highly radioactive materials.
- Provides maximum safety under accident and transport conditions.

Radiation Transport Index (TI)

Classification of packages based on maximum radiation level:

Label	Max Surface Radiation Level
White-I	≤ 0.005 mSv/h
Yellow-II	> 0.005 mSv/h but ≤ 0.5 mSv/h
Yellow-III	> 0.5 mSv/h but < 2 mSv/h
Yellow-III*	> 2 mSv/h but ≤ 10 mSv/h

(*Used for high-radiation transport under strict safety measures.)

Professional Roles and Practices in Hospital Pharmacy

Role of Pharmacists

The pharmacy profession aims to safeguard public health.
Pharmacists:

- Prepare, dispense, and counsel patients on medications.
- Monitor patient outcomes based on prescriptions from licensed health professionals.
- Work in hospital pharmacies, community pharmacies, managed care, long-term care, nuclear pharmacy, drug information centers, academia, and industry.

Hospital Pharmacy

A hospital pharmacy is a dedicated department within the hospital responsible for:

- 24-hour drug preparation and dispensing
- Clinical services
- Drug procurement, storage, compounding, packaging, and distribution
- Maintaining drug treatment records

Requirements:

- Minimum six beds
- Organized medical staff and nursing service
- Governing authority
- Licensed pharmacy service

Pharmacy Technicians

Assist pharmacists by:

- Delivering medications to wards
- Managing inventory
- Operating dispensing systems (manual or robotic)
- Certification is commonly required in hospital settings.

Hospital Pharmacist Duties

- Dispense oral and parenteral medications
- Provide advanced patient counseling and drug information
- Administer hospital pharmacy policies
- Purchase and manage drug supplies
- Monitor drug utilization and report adverse drug events

Code of Ethics for Hospital Pharmacists

With Patients/Public:

- Follow laws and prioritize patient safety
- Maintain confidentiality
- Avoid substandard products
- Educate patients about drug use

With Fellow Pharmacists:

- Uphold professional dignity and high standards
- Offer advice and professional support

With Other Healthcare Professionals:

- Collaborate for optimal patient care
- Provide unbiased drug information
- Address concerns privately

With Employing Institution:

- Follow hospital policies
- Act in the institution's best interest
- Maintain professional autonomy

With the Pharmaceutical Industry:

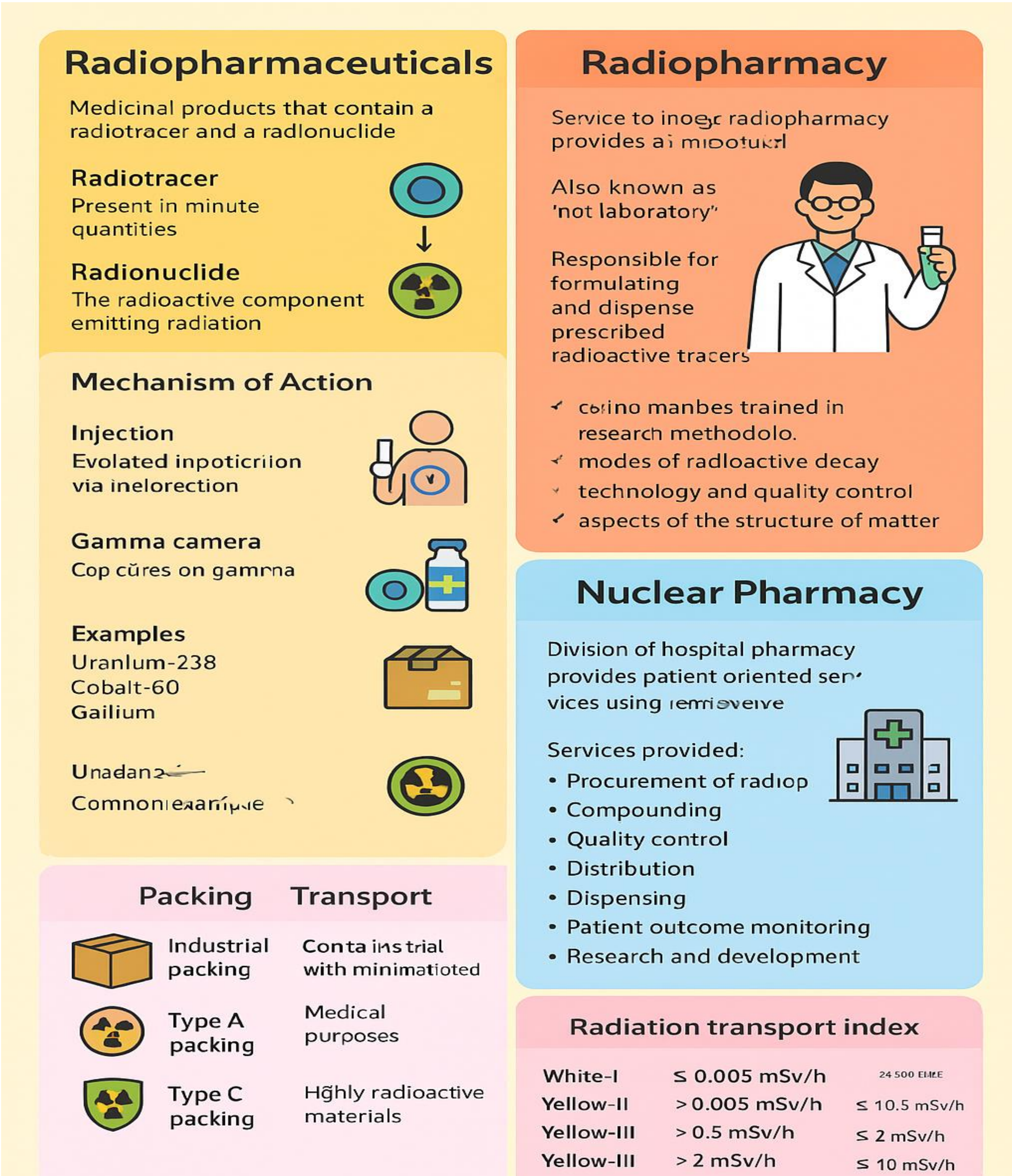
- Maintain honesty and integrity

- Avoid undue influence from product promotion

Roles of the Modern Pharmacist

Modern pharmacists have expanded roles, including:

- Dispensing and compounding medications
- Collecting and maintaining patient records
- Counseling on adverse effects and interactions
- Assisting with OTC medication selection
- Providing drug information to healthcare teams
- Advising on home healthcare products
- Monitoring therapy outcomes


Radiopharmaceuticals
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Radiotracer
Present in minute quantities
Radionuclide
The radioactive component emitting radiation
Mechanism of Action
Injection
Evolated inpoticriion via inelorection
Gamma camera
Cop cũres on gamrna
Examples
Uranlum-238
Cobalt-60
Gailium
Unadan2
Packing
Transport
Industrial packing
Conta ins trial with minimatioted
Type A packing
Medical purposes
Type C packing
Hğhly radioactive materials
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research methodolo.
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