General Pharmacology

Introduction to Pharmacology

Definition of Pharmacology

- Pharmacology is the branch of science that deals with the study of drugs and their interactions with living organisms.
- It encompasses the understanding of how drugs work, what they do to the body (pharmacodynamics), and what the body does to them (pharmacokinetics).
- It is a foundational discipline in medical and health sciences and is critical for developing and using medications safely and effectively.
- Pharmacology is not just about medications prescribed by doctors, but also includes chemicals used in diagnosis, prevention, and treatment of disease, as well as substances used for recreational purposes or that may be toxic.

Here are some core terms in pharmacology:

- **Drug**: A substance that, when administered to a living organism, produces a biological effect. This includes medicines used in diagnosis, treatment, or prevention of diseases.
- **Pharmacokinetics**: The study of how the body absorbs, distributes, metabolizes, and excretes a drug (i.e., what the body does to the drug).
- **Pharmacodynamics**: The study of the biochemical and physiological effects of drugs and their mechanisms of action (i.e., what the drug does to the body).
- **Therapeutics**: The branch of medicine concerned with the treatment and cure of diseases using drugs.
- **Toxicology**: The study of the adverse effects of drugs and chemicals on living organisms.
- **Pharmacy**: The science and practice of preparing, compounding, and dispensing drugs, as well as counseling patients on their proper use.

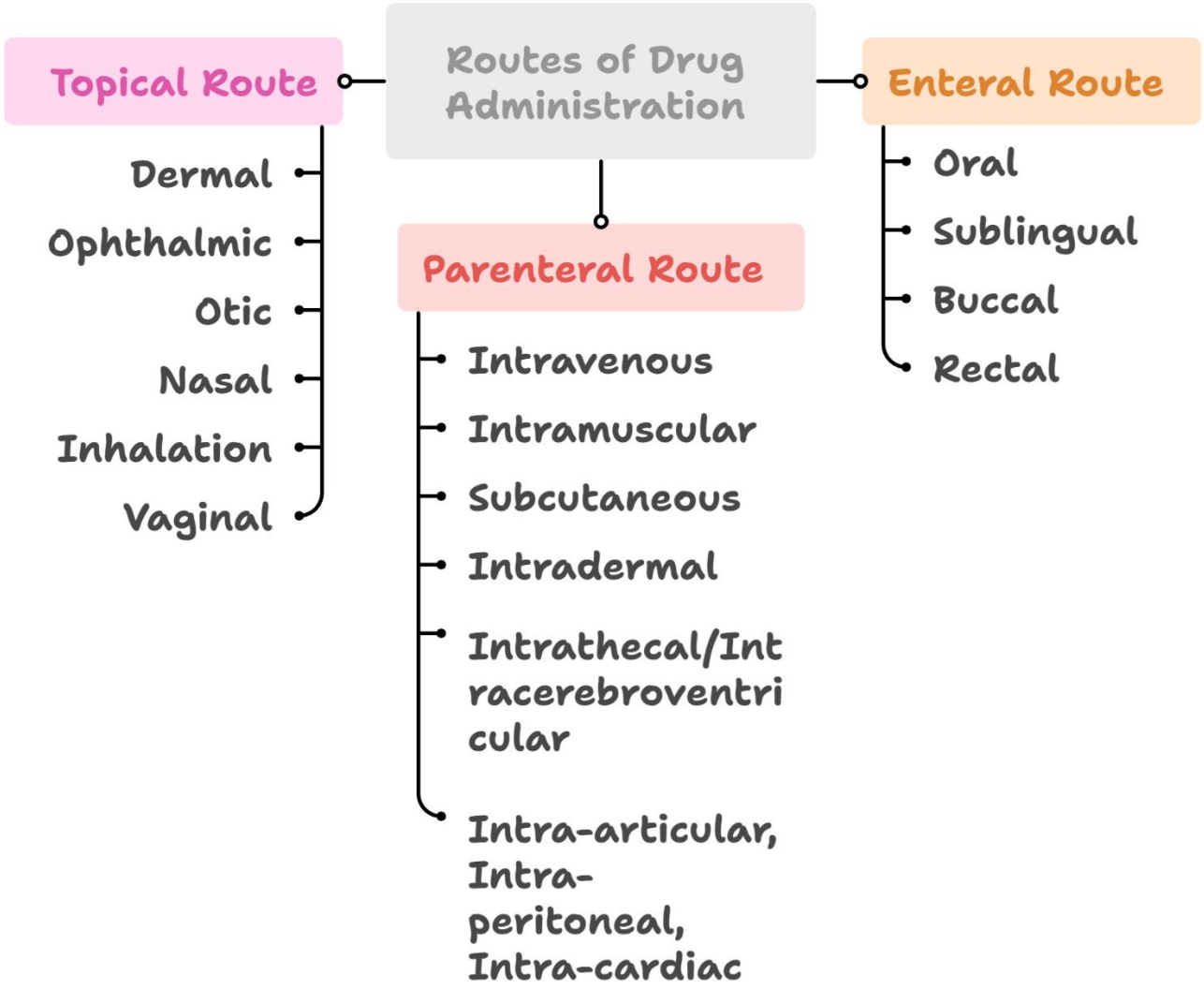
Scope of Pharmacology

1. **Drug Discovery and Development**: Involves identifying new drug molecules, conducting laboratory and clinical research to establish safety and efficacy.
2. **Clinical Pharmacology**: Focuses on the use of drugs in humans for the prevention and treatment of disease, including dosage adjustments and understanding adverse effects.
3. **Pharmacogenomics**: The study of how an individual's genetic makeup affects their response to drugs. It supports personalized medicine.
4. **Toxicology**: Covers the harmful effects of drugs, detection of poisons, and understanding mechanisms of toxicity.
5. **Regulatory Pharmacology**: Involves compliance with government regulations (e.g., FDA, EMA) concerning drug approval, labeling, and post-marketing surveillance.

6. **Veterinary Pharmacology**: Study of drugs used in animals.
7. **Environmental Pharmacology**: Study of environmental chemicals' effects on human health, including pollution-related exposure.
8. **Neuropharmacology**, **Cardiovascular pharmacology**, **Endocrine pharmacology**, etc., are subfields focusing on drugs acting on specific systems.

Routes of Administration of Drugs

- Drugs can be administered into the body through various routes depending on the desired speed of action, site of action, drug stability, patient compliance, and convenience.
- These routes are broadly classified into **enteral**, **parenteral**, and **topical** routes.



1. Enteral Route (via the gastrointestinal tract)

A. Oral (per os, PO)

- Most common and convenient route.
- Drug is swallowed and absorbed through the stomach or intestinal lining.
- **Advantages:**
  - Non-invasive and easy for self-administration.
  - Economical and safe.
- **Disadvantages:**
  - Slow onset due to absorption delay.
  - Subject to first-pass metabolism in the liver, which may reduce bioavailability.

- Not suitable for unconscious or vomiting patients.

B. Sublingual (under the tongue)

- Drug is placed under the tongue and absorbed directly into the systemic circulation.
- **Advantages:**
  - Bypasses the liver and avoids first-pass metabolism.
  - Rapid onset of action.
- **Disadvantages:**
  - Only suitable for small doses and highly lipid-soluble drugs.

C. Buccal (in the cheek pouch)

- Similar to sublingual; drug dissolves and is absorbed through the buccal mucosa.
- Useful for drugs requiring sustained release.

D. Rectal

- Drug is administered via the rectum in the form of suppositories or enemas.
- **Advantages:**
  - Useful in unconscious or vomiting patients.
  - Partial avoidance of first-pass metabolism.
- **Disadvantages:**
  - Erratic and incomplete absorption.
  - Patient discomfort and inconvenience.

2. Parenteral Route (bypasses the gastrointestinal tract)

These are injectable routes and are used when rapid or precise delivery is needed.

A. Intravenous (IV)

- Direct injection into a vein.
- **Advantages:**
  - 100% bioavailability.
  - Immediate effect; suitable for emergency situations.
  - Controlled administration via infusion.
- **Disadvantages:**
  - Requires sterile technique.
  - Risk of infection, embolism, or overdose.

B. Intramuscular (IM)

- Injection into a muscle (e.g., deltoid, gluteal).
- **Advantages:**
  - Faster absorption than oral but slower than IV.
  - Suitable for oily or depot preparations.
- **Disadvantages:**
  - Pain at injection site.
  - Risk of nerve or vascular injury.

C. Subcutaneous (SC)

- Injection into the subcutaneous tissue.
- **Advantages:**
  - Suitable for slow, sustained drug release (e.g., insulin).
- **Disadvantages:**
  - Slower absorption.
  - Limited volume can be administered.

D. Intradermal

- Injection into the dermis (e.g., for allergy testing, BCG vaccine).
- Small volume drugs only.

E. Intrathecal/Intracerebroventricular

- Injection into cerebrospinal fluid (CSF), used for drugs that need to act on the central nervous system and cannot cross the blood-brain barrier.
- High risk procedures requiring expertise.

F. Intra-articular, Intra-peritoneal, Intra-cardiac, etc.

- Used for specific conditions requiring drug administration into joint space, body cavity, or heart.

3. Topical Route

1. Dermal (Skin)

- Used for local effects (e.g., ointments, creams, lotions).
- Can also be used for systemic effect via transdermal patches (e.g., nicotine, fentanyl).

2. Ophthalmic (Eye)

- Eye drops or ointments for local ocular treatment.

3. Otic (Ear)

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