

INTRODUCTION - DEFINITIONS

- **Pharmacology**

It is the science that deals with the effects of drugs on living system.

- **Drug - (WHO) defines *drug* as**

'any substance or product' that is used or intended to be used to **modify physiological systems** or **pathological states** for the benefit of the recipient.

What is pharmacology

- Pharmacology is the branch of science that includes history, source, physical and chemical properties, compounding, mode of action, excretion, the therapeutic use and side effects of drug.

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DEFINITIONS

- **Toxicology**

It is the study of **poisons**, their actions, **detection**, **prevention** and the **treatment** of poisoning.

- **Clinical pharmacology**

It is the systematic study of a drug in **humans**—both in healthy volunteers and patients.

It includes the **evaluation** of **pharmacokinetic** and **pharmacodynamic** data, **safety**, **efficacy** and **adverse effects** of a drug.

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DEFINITIONS

- **Pharmacokinetics**

It means the movement of the drug within the body; it includes the processes of **absorption** (A), **distribution** (D), **metabolism** (M) and **excretion** (E). It means **'what the body does to the drug'**.

- **Pharmacodynamics**

It is the study of drugs—their **mechanism action**, **pharmacological actions** and their **adverse effects**. It covers all the aspects relating to **'what the drug does to the body'**.

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DEFINITIONS

- **Pharmacy**

It is the branch of science that deals with the **preparation, preservation, compounding** and **proper use** of drugs.

- **Therapeutics**

It is the aspect of medicine that is concerned with the treatment of diseases.

- **Chemotherapy**

It deals with the **treatment of infectious diseases/cancer** with chemical compounds that have **relatively selective toxicity** for the infecting organism/ cancer cells.



Sources of Drugs

- **Natural** - resources are plants, animals, minerals, microorganisms, etc.
- **Semisynthetic** - are obtained from natural sources and are chemically modified later.
- **Synthetic** - are produced artificially

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Examples

a. Plants:

i. Alkaloids, e.g. *morphine*, atropine, quinine.

ii. Glycosides, e.g. *digoxin*, digitoxin.

b. Animals: *Insulin*, heparin.

c. Minerals: *Ferrous sulphate*, magnesium sulphate.

d. Microorganisms: *Penicillin*, streptomycin.

e. Semisynthetic: *Hydromorphone*, hydrocodone.

f. Synthetic: Most of the drugs used today are synthetic, e.g. aspirin, *paracetamol*.

- Drugs are also produced by **genetic engineering (DNA recombinant technology)**, e.g. *human insulin*, human growth hormone, hepatitis B vaccine.



ROUTES OF DRUG ADMINISTRATION

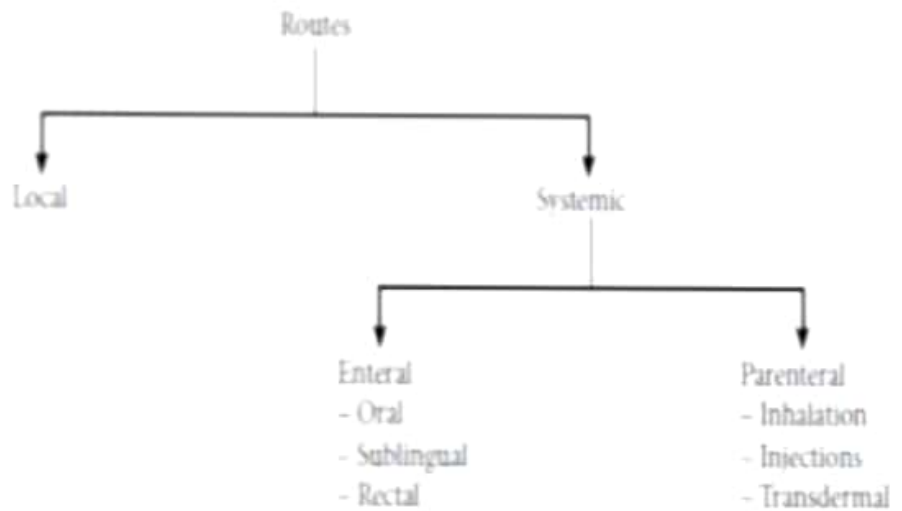
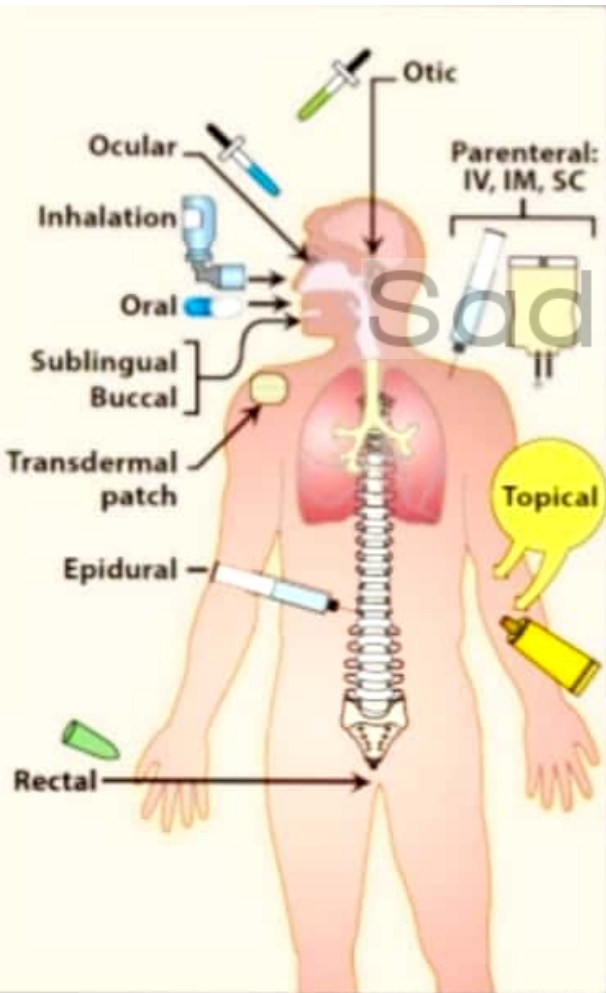
Drug- and patient-related factors determine the selection of routes for drug administration. The factors are:

1. Characteristics of the drug.
2. Emergency/routine use.
3. Site of action of the drug—local or systemic.
4. Condition of the patient (unconscious, vomiting, diarrhoea).
5. Age of the patient.
6. Effect of gastric pH, digestive enzymes and first-pass metabolism.
7. Patient's/doctor's choice (sometimes).



ROUTES OF DRUG ADMINISTRATION

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Figure 1.2

Commonly used routes of drug administration. IV = intravenous; IM = intramuscular; SC = subcutaneous.

Local Routes

Topical: Drug is applied to the skin or mucous membrane at various sites for local action.

- a. **Oral cavity:** as ointment and jelly, e.g. 5% lignocaine hydrochloride.
- b. **GI tract:** As tablet that is not absorbed, e.g. neomycin (for sterilization of gut before surgery).
- c. **Rectum and anal canal:**
 - i. **As an enema** (administration of drug into the rectum in liquid form):
 - **Evacuant enema** (for evacuation of bowel).
 - **Retention enema:** For example, methylprednisolone in ulcerative colitis.
 - ii. **As a suppository** (administration of the drug in a solid form into the rectum). Eg: Glycerin for constipation

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Routes and Administration



- **Direct Application:** lotions, creams, transdermal
- **Sublingual:** under the tongue, tablets, liquid, drops
- **Buccal:** in the cheek, tablets
- **Rectal:** suppositories, ointments
- **Vaginal:** suppositories, creams, etc...
- **Inhalation:** inhalers, oxygen, sprays
- **Instillation:** liquid, drops (eyes and ears)
- **Parenteral:** injections

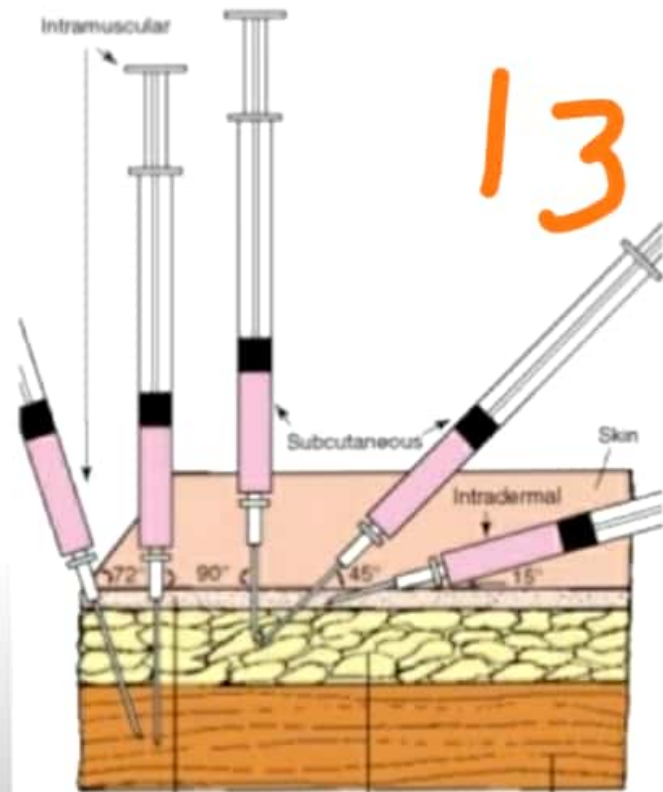


ROUTE OF ADMINISTRATION	ABSORPTION PATTERN	ADVANTAGES
Rectal	<ul style="list-style-type: none"> ● Erratic and variable 	<ul style="list-style-type: none"> ● Partially bypasses first-pass effect ● Bypasses destruction by stomach acid ● Ideal if drug causes vomiting ● Ideal in patients who are vomiting, or comatose
Inhalation	<ul style="list-style-type: none"> ● Systemic absorption may occur; this is not always desirable 	<ul style="list-style-type: none"> ● Absorption is rapid; can have immediate effects ● Ideal for gases ● Effective for patients with respiratory problems ● Dose can be titrated ● Localized effect to target lungs: lower doses used compared to that with oral or parenteral administration ● Fewer systemic side effects

Parenteral Routes

Routes of administration other than enteral route are called parenteral routes.

- **Intravenous (i.v.) route:** Drugs are injected directly into the blood stream through a vein. Drugs are administered as:
 1. *Bolus*
 2. *Slow intravenous injection*
 3. *Intravenous infusion*
- **Intramuscular (i.m.) route:** Drugs are injected into large muscles
- **Intradermal route:** The drug is injected into the layers of the skin. It is painful and only a small amount of the drug sensitivity tests.
- **Subcutaneous (s.c.) route:** The drug is injected into the subcutaneous tissues of the thigh, abdomen and arm, e.g.



Sublingual/Buccal Route

The preparation is kept under the tongue. The drug is absorbed through the Sublingual/buccal mucous membrane and enters the systemic circulation directly, e.g. nitroglycerin for acute anginal attack.



Buccal

Sublingual

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buccal mucosa. Ex- GTN,

DISADVANTAGES

- Unpalatable & bitter drugs
- Irritation of oral mucosa
- Large quantities not given
- Few drugs are absorbed



Sublingual

- Medication is placed under the tongue until absorbed
- Drug is mainly absorbed into the blood vessels under the tongue
- Caution client not to swallow



Buccal

- Medication is placed between the cheek and the teeth and held there until absorbed
- Medication is in tablet form
- Caution client not to swallow



Systemic Routes

Drugs administered by this route enter blood and produce systemic effects.

Enteral Routes

It includes oral, sublingual and rectal routes.

Oral Route

It is the most common and acceptable route for drug administration. Dosage forms are tablet, capsule, syrup etc.



ROUTE OF ADMINISTRATION	ABSORPTION PATTERN	ADVANTAGES	DISADVANTAGES
Oral	<ul style="list-style-type: none">• Variable; affected by many factors	<ul style="list-style-type: none">• Safest and most common, convenient, and economical route of administration	<ul style="list-style-type: none">• Limited absorption of some drugs• Food may affect absorption• Patient compliance is necessary• Drugs may be metabolized before systemic absorption

ABSORPTION PATTERN

ADVANTAGES

DISADVANTAGES

- Absorption not required

- Depends on drug diluents:
Aqueous solution: prompt
Depot preparations: slow and sustained

- Depends on drug diluents:

- Can have immediate effects
- Ideal if dosed in large volumes
- Suitable for irritating substances and complex mixtures
- Valuable in emergency situations
- Dosage titration permissible
- Ideal for high molecular weight proteins and peptide drugs

- Suitable for slow-release drugs
- Ideal for some poorly soluble suspensions

- Suitable if drug volume is moderate

- Unsuitable for oily substances
- Bolus injection may result in adverse effects
- Most substances must be slowly injected

- Strict aseptic techniques needed

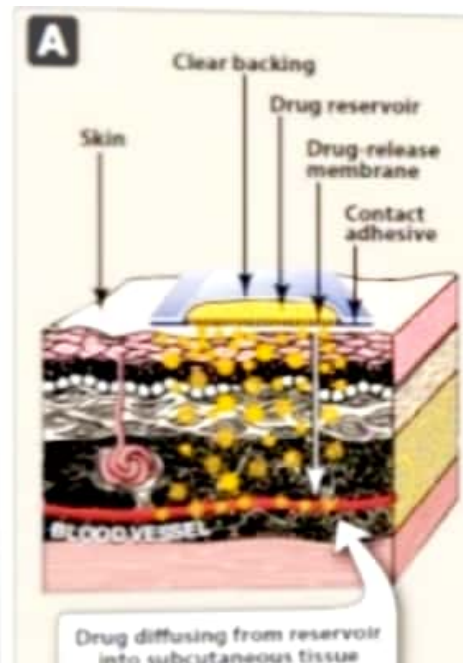
- Pain or necrosis if drug is irritating
- Unsuitable for drugs administered in large volumes

- Affects certain lab tests (creatinine kinase)

For example, nitroglycerin patch.



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ROUTE OF ADMINISTRATION	ABSORPTION PATTERN	ADVANTAGES	DISADVANTAGES
Transdermal (patch)	<ul style="list-style-type: none">● Slow and sustained	<ul style="list-style-type: none">● Bypasses the first-pass effect● Convenient and painless● Ideal for drugs that are lipophilic and have poor oral bioavailability● Ideal for drugs that are quickly eliminated from the body	<ul style="list-style-type: none">● Some patients are allergic to patches, which can cause irritation● Drug must be highly lipophilic● May cause delayed delivery of drug to pharmacological site of action● Limited to drugs that can be taken in small daily doses

Special Drug-Delivery Systems

- **Intraoral lignocaine patch:** Patch containing lignocaine is used to anaesthetize the oral mucosa.

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