










## LEARNING OBJECTIVES

After mastering the contents of this lecture, Students will be able to,

-  define the terminologies used in pharmacology
-  list the importance of pharmacology for nurses
-  enlist the sources of drugs
-  enumerate the forms of medication
-  describe about classification of drugs
-  explain about the pharmacodynamics
-  describe about pharmacokinetics

உற்றவன் தீர்ப்பான் மருந்து உழைச் செல்வானென்று  
அப்பால்தான் கூற்றே மருந்து.

- திருக்குறள்

*For patient, leech, and remedies, and him who  
waits by patient's side,  
The art of medicine must fourfold code of laws  
provide.*

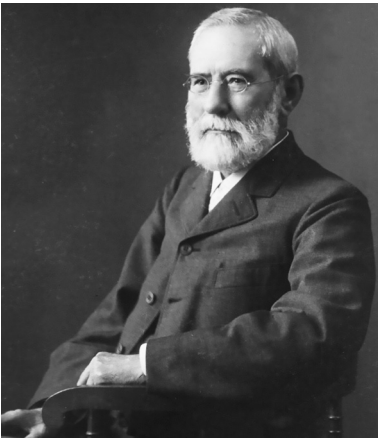
### 11.1 Introduction



Medications are frequently used to manage diseases. Administration of

medication is the main responsibility of a nurse. Hence it becomes important that nurses should have a sound knowledge of actions and effects of medications. Administering medication safely requires an understanding of all aspects of pharmacology.

All around the world, registered nurses play an important role in administering medication to patients in a typical busy hospital environment. This duty requires a huge amount of effort on behalf of nurses to stay updated about medical advancements and pharmaceutical drugs. Improving knowledge about medication requires a continuous education on drugs among nurses.



Schmiedeberg obtained his medical doctorate in 1866 with a thesis on the measurement of chloroform in blood. In 1872, he became professor of pharmacology at the University of Strassburg, receiving generous government support in the form of a magnificent institute of pharmacology. He studied the pharmacology of chloroform and chloralhydrate. In 1869, Schmiedeberg showed that muscarine evoked the same effect on the heart as electrical stimulation of the vagus nerve. In 1878, he published a classic text, ***Outline of Pharmacology***, and in 1885, he introduced urethane as a hypnotic.

### 11.2 Definition:

The term pharmacology is obtained from the Greek word “**pharmakon**” meaning as drug and “logos” means the study or science. The term “drug” is derived from the French word “drogue” denotes “dry herb”.

**PHARMACOLOGY:-** is the study of drugs. Drugs are the chemical substance that produce therapeutically useful effects.

**Pharmacist:** A person licensed to prepare and dispense drugs

**Pharmacokinetics:** It is the study of how medications enter the body, reach their site of action, are metabolized and exit the body

**Pharmacodynamics:** It is the study of drugs – their mechanism of action, pharmacological action and their side effects which deals with “what the drug does to the body”

### 11.3 Sources Of Drugs:

There are three varieties of sources – natural, semisynthetic and synthetic. Natural sources are plants, animals, microorganism, minerals, etc. semisynthetic drugs are obtained from natural sources and modified chemically later. Synthetic drugs are produced artificially.

**The different sources of drugs are as follows:**

Plants – morphine, atropine, digoxin

Animals – insulin

Minerals – ferrous sulphate, magnesium sulphate

Microorganisms – penicillin, streptomycin

Semisynthetic – hydromorphone

Synthetic – most of the drugs used today are synthetic – aspirin, paracetamol

Drugs are also produced by genetic engineering – human insulin, human growth hormone

### 11.4 Forms of Medication:

Medications are available in a variety of forms or preparations. The form of medication determines the route of administration.



1. Solid forms are tablet, capsule, gelatine capsule (TAB).



2. Liquid forms are syrup, elixir (SYP)



3. Inhalation forms are aerosol, lozenge



4. Topical forms are ointment, lotion



5. Parenteral forms are powder, solution vial



6. Instillation forms are suppository, intraocular disk



Anaphylactic reaction may lead to anaphylactic shock which is a medical emergency can lead to sudden death. e.g. penicillin.

## 11.5 Classification of Drugs

There following are a classification of drugs according to the action

1. **ANALGESICS:-** Drugs used to relieve pain.
2. **ANAESTHETICS:-** Drugs which causes loss of sensation.
3. **ANTI -PYRETICS:-** Drugs which reduce fever.e.g crocin
4. **ANTHELMINTICS:-** Drugs which destroy and expel worms.e.g mebendazole
5. **ANTIDOTES:-** Substance used to counteract effects of poison. eg large quantity of diluted alkali is given to neutralize acid poisoning.
6. **ANTACIDS:-** Substance that react with hydrochloric acid to decrease

the activity of the gastric secretions  
e.g. gelucil

- 7. ANTI-EMETICS:-** Drugs relieving or preventing nausea and vomiting.
- 8. ANTI-HISTAMINES:-** The agents which used to prevent or relieve allergies.
- 9. ANTI-COAGULANTS:-** Substance which inhibit or decrease blood – clotting process .
- 10. ANTI-CONVULSANTS:-** Use to treat convulsion
- 11. ANTI- SEPTIC:-** A Substance that inhibit the growth of bacteria.
- 12. DIURETICS:-** Which increase the flow of urine.ex. lasix
- 13. EMOLLIENT:-** Substance that soften, smooth and protect the skin.
- 14. EXPECTORANTS:-** Increase the bronchial secretions and aid in the expulsion of the mucus.
- 15. HYPNOTICS:-** Drugs that produce sleep.
- 16. HYPOGLYCAEMICS:-** Drugs that lower the blood sugar level.
- 17. MUSCLE RELAXANTS:-** Agents used for diminution of tension or functional activity of muscles.
- 18. NASAL DECONGESTANTS:-** Drugs which used to relieve the nasal congestion.
- 19. NARCOTICS:-** A drugs that reduce complete insensibility.
- 20. SEDATIVES:-** Substance which lessen the body activity and induce sleep.

**21. STIMULANTS:-** Increase the functional activity of an organ or system. Ex. Ampitamine induce Nervous system

**22. TRANQUILLIZERS:-** To calm nervous anxious, excited or disturbed helps client.

**23. VASODILATOR:-** It reduce blood pressure

**24. EMETICS:-** Drugs which produce vomiting

**25. MYDRIATICS:-** Drugs which dilate pupil of the eye

### 11.6 Importance of Pharmacology for Nurses

- 1.** Understand drugs and how they can affect living things
- 2.** Know the right dosage of drugs and not just quantity
- 3.** Identify and respond to drug interactions, reactions and side effects and treat accordingly
- 4.** Know when to use drugs because some conditions do not need drug therapy
- 5.** Understand the process of drug intake, absorption, distribution, metabolism and elimination.
- 6.** Identify the properties of ideal drugs and otherwise it will create problem.
- 7.** Know the application of pharmacology in nursing with regards to the right of medication administration.

## Abbreviations Used Regarding Time of Administration

Abbreviation	Derivation	Meaning
A.C	Ante cibum	Before meals
P.C	Post cibum	After meals
O.D	Omni die	Daily (once a day)
H.S	Hora somni	At bedtime
S.O.S	Si opus sit	If necessary
B.D	Bis in die	Twice a day
T.I.D	Ter in the die	Three times a day
Q.I.D	Quater in die	four time a day
STAT	Statim	At once
Q	Quaque	Every

### EXAMPLES:-

- Q4H:- Every 4 hours (6 Times a day)  
8-12-4  
8-12-4
- Q6H:- Every 6 hours (4 Times a day)  
6-12  
6-12

## Abbreviations Used Regarding the Route

Abbreviation	Meaning
IM	Intramuscular
P.O	Per Oral
IV	Intravenous
SC	Subcutaneously
ID	Intradermal

## 11.7 Types of Order

### Standing Order

This is one that should be carried out for a specified number of days or until another order cancels it. For example, standing orders given by the medical officer of PHC in emergency situations.

### Prn Orders

It states guidelines for administering a medication when needed.

(e.g., pain killers, laxatives.)

### One Time Order or Single Order

It is a written order for a medication which is administered only once, (e.g., preoperative medications.)

### Stat Order

It is a medication order which is administered immediately and only once,

(e.g., INJ Lasix 20 mg IV stat.)

### Telephone Orders

Sometimes after discussion with the doctor about the clients condition over the phone, the nurse may write the ordered medication on the physicians order sheet which is designated as "T.O." The physician must countersign the order at a specified time period, which is usually 48 hours.

## 11.8 Preventing Medication Error

To help prevent errors, perform 'three checks' and "six rights" when giving medication.



### ■ THREE CHECKS:

Check each medication three times as a nurse:

1. *BEFORE you mix or draw up a medication*, check its label against the entry on the MAR. be sure that the name, route, dose, and time match the MAR entry. [medication administration record]
2. *AFTER you prepare the medication*, and before returning the container to the medication cart or discarding anything, check the label against the MAR entry again.
3. *AT THE BEDSIDE*, check the medication again before actually administering it.

**Observing the “three checks” rule will help you to practice the “six rights”**

#### 11.8.1 Six Rights of Medication Administration

Practicing the six rights’ will help to ensure accurate administration. This means the nurses will give the right medication to Right patient, by using Right dose, at the Right route in a Right time, and Right document ation is necessary for medication administration.

##### 1. RIGHT DRUG:

- Always check the doctor order before administer.

##### 2. RIGHT DOSE:

- Be sure that the dose is within the recommended range for the patients age and condition.

##### 3. RIGHT TIME:

- Exact time of administration of the medication is needed.

##### 4. RIGHT ROUTE:

- Be sure that the drug is in the proper form for the route ordered. Be sure about site of administration.

##### 5. RIGHT PATIENT:

- Always double check the patients identification. To ensure correct patient.

##### 6. RIGHT DOCUMENTATION:

- After administering of medication, document it immediately on the patients case sheet.

#### 11.8.2 Patient Rights:

In addition to the” “six rights” already discussed, patients also have the following rights.

##### ■ RIGHT REASON:

Right to not receive unnecessary medication, for example sleeping pill should be give because the patient is very anxious or cannot sleep not for the convenience of the caregivers.

##### ■ RIGHT TO KNOW:

This means that you tell the patient about name of the medication, why it is being given, its action, and potential side effects

##### ■ RIGHT TO REFUSE:

The patient always as a right to refuse a medication.

#### Students Activity

Prepare an album on various forms of medication

## DEFINITION

Medication error can be defined as ‘a failure in the treatment process that leads to, or has the potential to lead to, harm to the patient’.

**These are not adverse drug reactions**

**Medication errors can occur in:**

- choosing a medicine—irrational, inappropriate, and ineffective prescribing, underprescribing and overprescribing;
- writing the prescription—prescription errors, including illegibility;
- manufacturing the formulation to be used—wrong strength, contaminants or adulterants, wrong or misleading packaging;
- dispensing the formulation—wrong drug, wrong formulation, wrong label;
- administering or taking the drug—wrong dose, wrong route, wrong frequency, wrong duration;
- monitoring therapy—failing to alter therapy when required, erroneous alteration.

## 11.9 Systems of Medication Measurement

**Metric system:** Most commonly used and convenient system. Basic units of measurements are metre, litre and gram.

**Apothecary system:** Infrequently used and basic unit of measurements are grain, minim.

**Household system:** Least accurate and used only in houses. Basic units of measurements are teaspoon, tablespoon.

**Conversion within systems:**

$$1\text{g} = 1000\text{mg}, \quad 1\text{L} = 1000\text{ml}$$

Metric	Apothecary	Household
1ml	15 to 16 minim	15 drops
4-5ml	1 fluidram	1 tsp
15-16ml	4 fluidram	1 tbsp
30ml	1 ounce	2 tbsp
240ml	8 ounce	1 cup
480 ml (apprx. 500 ml)	1 pint	1 pint
960 ml (apprx. 1 lt.)	1 quart	1 quart
4800 ml (apprx. 5 lt.)	1 gallon	1 gallon

## 11.10 Routes of Medication Administration

There are 5 major routes of medication administration that includes:

### I. Oral route:

- Oral
- Enteral (through enteral tube)
- Buccal (placing between cheek and gum)
- Sublingual (placing under tongue)

### II. Parenteral route:

- Intradermal (under epidermis)

- Subcutaneous (under dermis)
- Intramuscular
- Intravenous
- Intra arterial
- Intra cardiac
- Intra osseous (bone)

### III. Topical route:

- Vaginal administration
- Rectal administration
- Inunction (rubbing drug into skin)
- Instillation (placing drug into direct contact with mucous membrane)
- Irrigation (flushing mucous membrane with drug in solution)
- Skin application (Applying transdermal patch)

### IV. Inhalation or Pulmonary Route:

- Through nasal, oral, endotracheal or tracheostomy tubes

### V. Intraocular Route:

- Eye medication disk (inserting similar to contact lens)

### Students Activity

Visit to a Pharmacy in Government Hospital

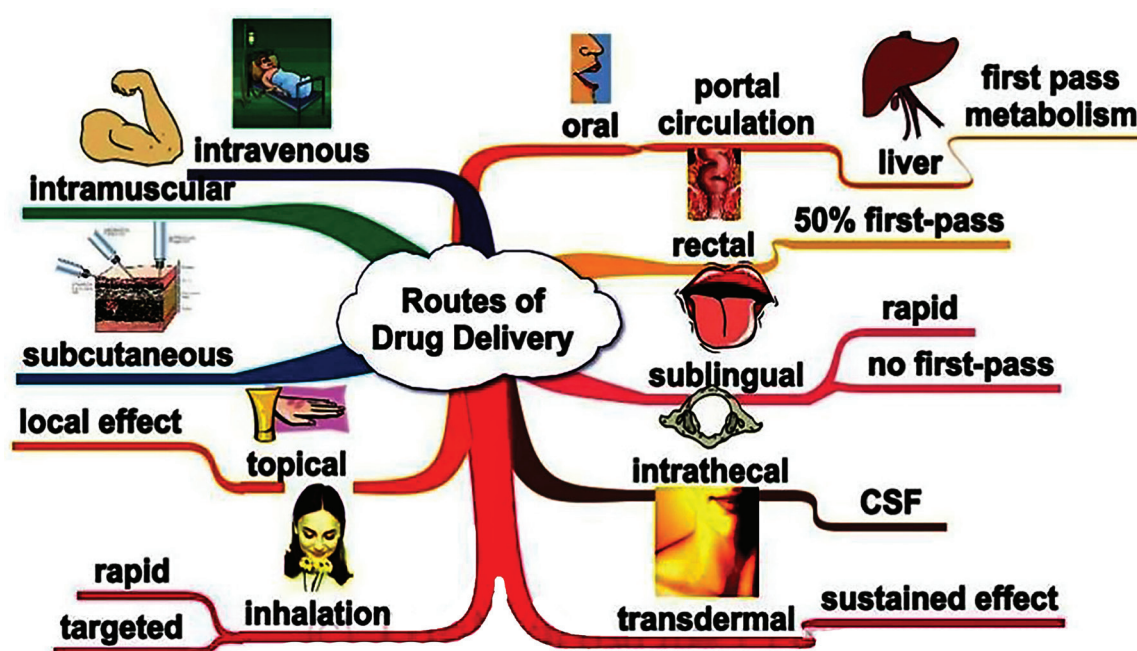
## 11.11 Pharmacodynamics

It covers all the aspects relating to “what the drug does to the body”. It is the study of biochemical and physiological effects of drug and their mechanism of action at organ level as well as cellular level.

### 11.11.1 Types of Drug Action:

Different types of drug actions are follows:

**Stimulation:** Some drugs act by increasing the activity of specialised cells, eg., catecholamine stimulate heart to increase heart rate and force of contraction.





**Depression:** Some drugs act by decreasing the activity of specialised cells, eg., general anaesthetics depress the central nervous system.

**Irritation:** Certain drugs on topical application can cause irritation of the skin and the adjacent tissues, eg., eucalyptus oil.

**Replacement:** When there is a deficiency of endogenous substances, they can be replaced by drugs, eg., Insulin.

**Chemotherapeutic:** Drugs are selectively toxic to infective organism or cancer cells, eg., antibiotics, anticancer drugs.

### 11.11.2 Effects of Drugs on the Body

**THERAPEUTIC EFFECTS:** It is the expected or predictable physiological response of medication. The drugs are administered for the following purpose.

1. **TO PROMOTE HEALTH;**- Drugs are given to the individual to increase the resistance against diseases (e.g. vitamins).
2. **TO PREVENT DISEASES;**- (e.g. vaccines and anti-toxins).
3. **TO DIAGNOSE DISEASE:-** (e.g. barium used in the X-ray studies).
4. **TO ALLEVIATE DISEASES:-** Certain drugs are given for the palliative effect or for the temporary relief of distressing symptoms but does not remove the cause or cure the disease (e.g. analgesics)
5. **TO TREAT OR CURE A DISEASE:-**
  - By restoring normal functions (e.g. digoxin).

- By destroying the causative organisms (e.g. quinine in malaria.)

### Local and Systemic Effects

Local effects of a drug are expected when they are applied topically to the skin or mucus membrane.

A drug used for systemic effect must be absorbed into the blood stream to produce the desired effects in the various systems and parts of the body.

### Adverse Effects:

Adverse effect is any effect other than the therapeutic effect. These are generally considered severe responses to medication.

### Side Effects:

Side effect are the minor adverse effects side effects can harmful or harmless.

### Allergic Reactions:

A client can react to a drug as a foreign body and thus develop symptoms of allergic reaction. Allergic reaction can be either severe or mild. A severe allergic reaction usually occurs immediately after the administration of the drugs it is called *anaphylactic reaction*. A mild reaction has a variety of symptoms. From skin rashes to diarrhoea. Such as:

**SKIN RASHES:** (urticaria) Oedematous pinkish elevation with itching .

**PRURITIS:** Itching of the skin with or without a rash.

**RHINITIS:** Excessive watery discharge from the nose.

**LACRIMAL TEARING:** Excessive tears from the eyes.

### Students Activity

State any one drug that you are commonly using in your home for minor ailments and describe about its action and side effects.

### Proven Human Teratogens:

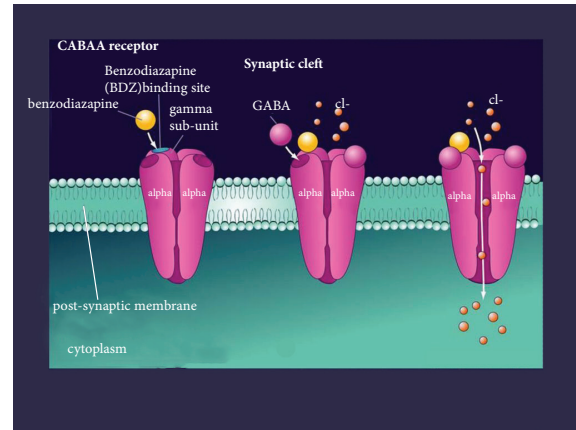
Drug	Abnormality
Thalidomide	Phocomelia, multiple defects
Anti-neoplastic drugs	Multiple defects, foetal death
Androgens	Virilization, esophageal, cardiac defects
Progestins	Virilization of female foetus
Stilboestrol	Vaginal carcinoma
Tetracyclines	Discoloured teeth, bone defects
Warfarin	Nose, Eye, Hand defects, Growth retardation
Phenytoin	Cleft lip/palate,
hypoplastic phalanges	microcephaly,



#### Teratogenic drugs:

A teratogen is an agent that can disturb the development of the embryo or fetus. This produce a congenital malformation (a birth defect) ex., radiation exposure, drugs used for maternal infection.

### 11.12 Mechanism of Drug Action



#### Two types of mechanisms

1. Non-receptor mediated
2. Receptor mediated

#### Non-receptor mediated mechanisms include:

1. By physical action like osmosis, absorption.
2. By chemical action like antacids, metals.
3. Through enzymes like angiotensin converting enzyme inhibitor.
4. Through antibody production like vaccines.
5. Placebo which is a dummy medicine having no pharmacological activity like distilled water.

#### Receptor mediated mechanisms include:

1. Affinity: Ability of the drug to get bound to the receptor.
2. Agonist: Capable of producing pharmacological action after binding to the receptor.
3. Antagonist: Capable of not producing pharmacological action after binding to the receptor.

**Drug Potency:** It is the quantity of a drug to produce a desired response. The lower the dose required for a given response, the more potent is the drug.

**Drug Efficacy:** It is the maximum effect of a drug. If the therapeutic index increases there is an increase in the safety of the medicine. Therapeutic index (TI) =  $\frac{TD_{50}}{ED_{50}}$ .  $ED_{50}$  = Dose of drug observed to yield half maximal efficacy.  $TD_{50}$  = Dose of drug observed to yield half maximal toxicity.

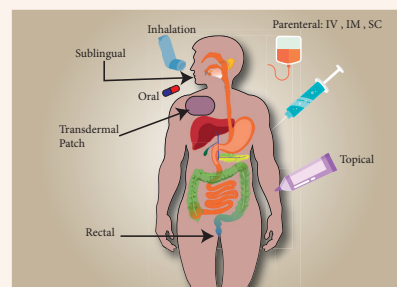
### 11.13 Pharmacokinetics

It is “what the body does to the drug”. It includes absorption, distribution, metabolism and excretion.



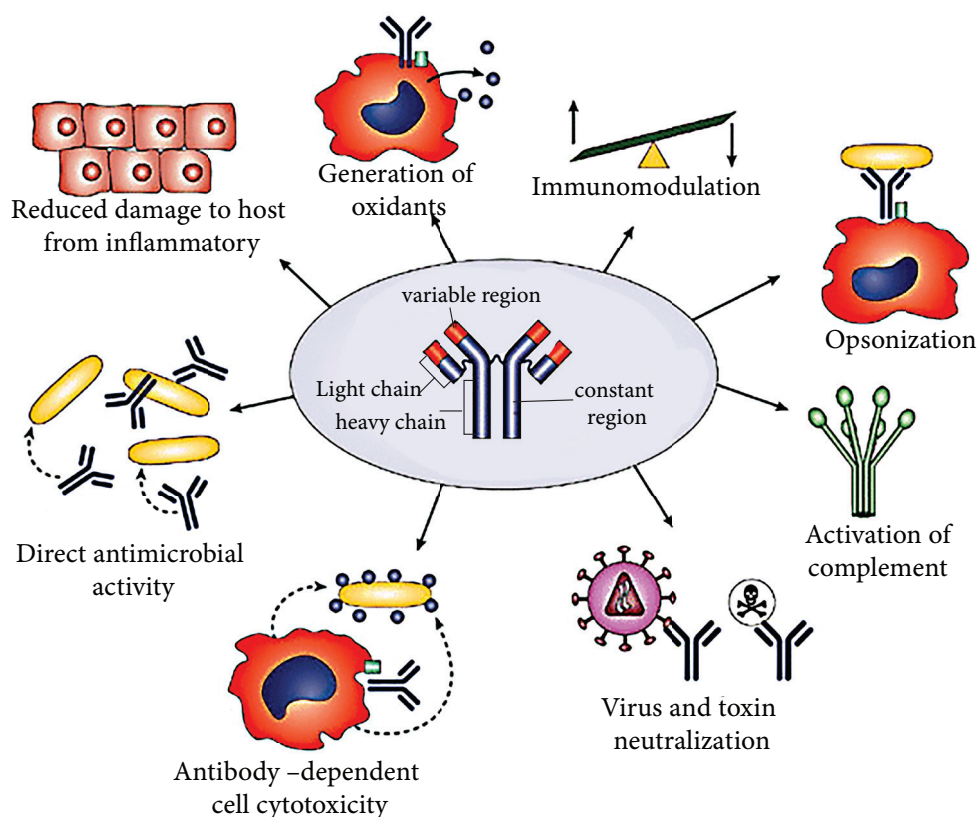
### 11.13.1 Drug Absorption:

#### DEFINITION

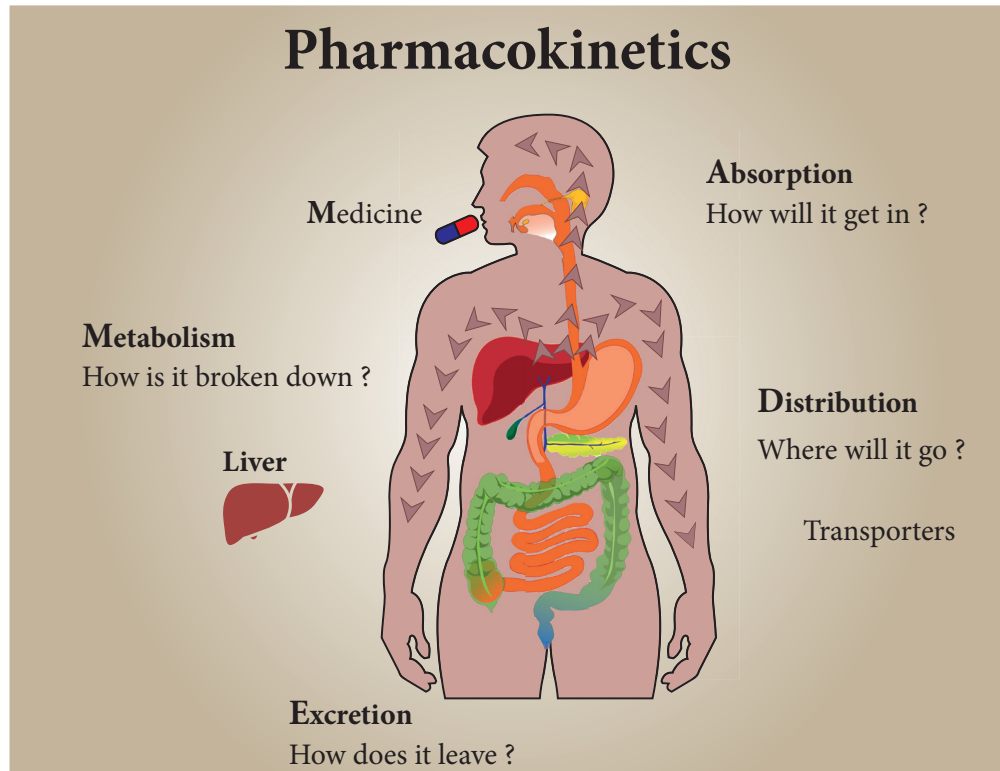


“The process of movement of unchanged drug from the site of administration to systemic circulation is called as drug absorption”.

It is the movement of a drug from the site of administration into the blood stream. There are various factors influencing drug absorption. It includes:



# Pharmacokinetics



- **Physiological properties of the drug.** eg., lipid soluble form better absorbed than water soluble.
- **Route of drug administration.** eg., intravenous route directly enters the circulation.
- **Food** eg., milk and milk products decrease the absorption.
- **Presence of other drugs** eg., ascorbic acid increases the absorption of oral iron.
- **Gastrointestinal and other diseases** eg., gastroenteritis decreases drug absorption.

## 11.13.2 Drug Distribution

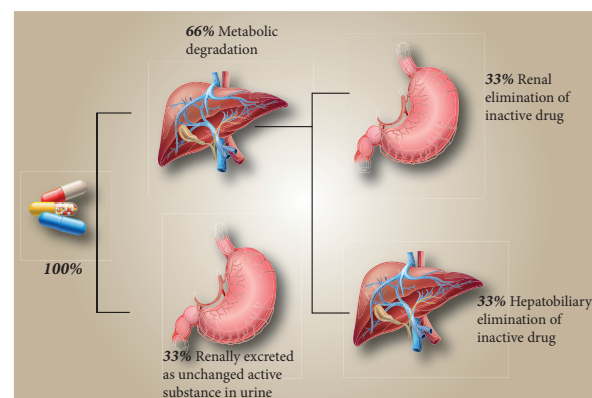
Drug distribution: refers to the reversible transfer of a drug between the blood and the extra vascular fluids and tissues of the body (for example, fat, muscle, and brain tissue). Drugs come into the circulation after absorption. From plasma drugs have to cross

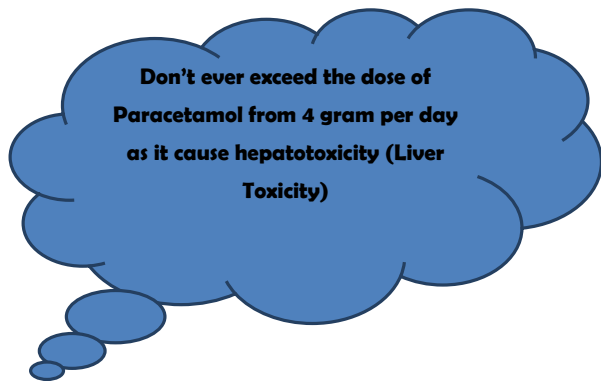
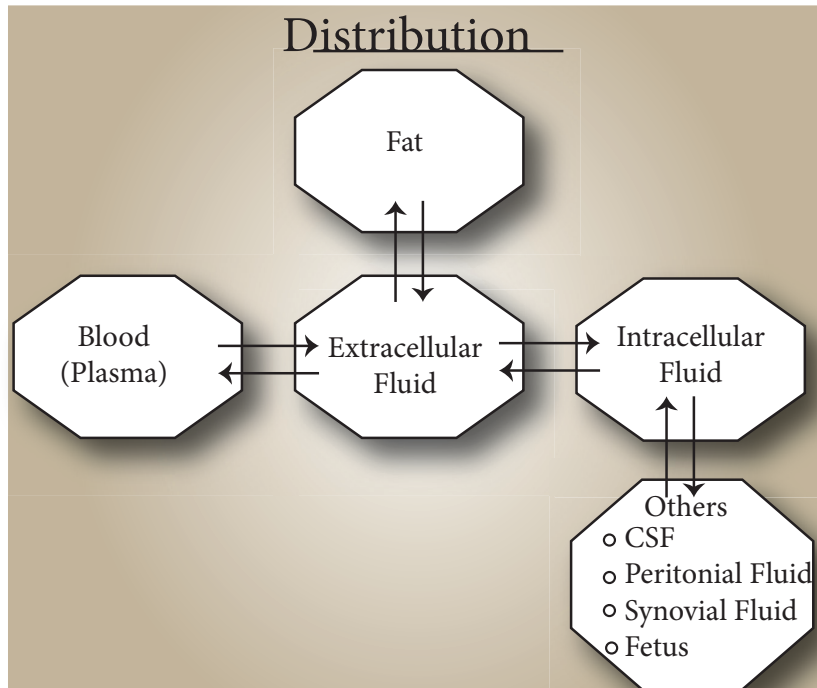
the capillary membrane to come to interstitial space then it cross the cell membrane and enter into the intracellular fluids.

## 11.13.3 Drug Metabolism

- Chemical alteration of the drug in a living organism is called drug metabolism or biotransformation.

**Site:** Liver is the main site for drug metabolism; other sites are GI tract, kidney, lungs, blood, skin and placenta.





### Factors Affecting Drug Metabolism

**Age:** Neonates and elderly metabolize to a lesser extent than adults.

**Diseases:** Liver diseases impair the drug metabolism.

#### 11.13.4 Drug Excretion

Removal of the drug and its metabolites from the body is known as drug excretion. The main channel of excretion of drugs is the kidney; others include lungs, bile, faeces, sweat, saliva, etc.

### 11.14 Nurses Responsibility in the Administration of Medications

- Assess gag reflex and patients ability to swallow.
- Do not touch tablets.
- Head end of the bed should be elevated at least by 90 degrees to administer oral medications.
- Make sure the patient has swallowed the medication.
- It is essential to hand wash before preparation of drugs.
- Always check for patients history for allergies.
- Check the expired dates of drugs and before administering.
- Never administer medications prepared by another staff member.





- Before administering unfamiliar drugs try to know the route of administration, dose or combination of medications.
- Explain the procedure to the client discuss the need for medication.
- Before administering the anti hypertensive medication check BP.
- Before administering an analgesics assess the type of pain it's intensity, and location.
- Report on error in medication immediately to the charge nurse and the physician.

- Record the date, time, name of the drug administered. The dose of the medicine and the strength immediately after the medicine.



## SUMMARY

All around the world, registered nurses play an important role in administering medication to patients in a typical busy hospital environment. Improving knowledge about medication requires a continuous education on drugs among nurses.



## EVALUATION

### I. Choose the correct answer

1. The study that deals with chemicals that affect the body functioning is known as
  - a) Pharmacokinetics
  - b) Pharmacology
  - c) Pharmacodynamics
  - d) Anaesthetics
2. The Drugs which produce vomiting is known as
  - a) Coagulant
  - b) Sedatives
  - c) Emetics
  - d) Antacids
3. The abbreviation used to administer of they if necessary is
  - a) SOS order
  - b) STAT order
  - c) prn order
  - d) o.d

4. The expected or predictable physiological response of medication is termed as

- a) Side effect
- b) Toxic effect
- c) Adverse effect
- d) Therapeutic effect



5. The process of movement of drug from the site of administration to systemic circulation is called as
  - a) Absorption
  - b) Distribution
  - c) Metabolism
  - d) Excretion
6. The main site for drug metabolism is
  - a) Kidney
  - b) Blood
  - c) Liver
  - d) Skin

## II. Answer the following questions in one (or) two lines.

1. Define Pharmacokinetics.
2. Define Pharmacodynamics.
3. List four sources of drugs.
4. Enumerate any four rights of medication administration.

## III. Write short notes

5. Describe the different forms of medications.

6. Describe the different routes of medication administration.
7. Write short notes on three checks for preventing medication error.

## IV. Write in detail

8. Explain the classification of drugs.
9. Explain about pharmacodynamics.
10. Explain about pharmacokinetics.

## A-Z GLOSSARY

1. Drug Efficacy: (மருந்து திறன்) It is the maximum effect of a drug.
2. Drug or Medication: (மருந்து) Any substance that modifies body functions when taken into the body
3. Drug Potency: (மருந்து சக்தி (அ) ஆற்றல்) It is the quantity of a drug to produce a desired response.
4. Pharmacodynamics: (மருந்தியல் இயக்கவியல்) It is the study of drugs – their mechanism of action, pharmacological action and their side effects which deals with "what the drug does to the body"
5. Pharmacist: (மருந்தாளர்) A person licensed to prepare and dispense drugs
6. Pharmacokinetics: (மருந்தினால் இயக்கவியல்) It is the study of how medications enter the body, reach their site of action, are metabolized and exit the body
7. Pharmacology: (மருந்தியல்) The study that deals with chemicals that affect the body's functioning



## REFERENCES

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- Potter P A, et al., (2013). Potter & Perry's Fundamentals of Nursing (1st ed.) Newdelhi: Elsevier
- Shanbhag, T.V., et al., (2011). Pharmacology for Nurses. Newdelhi: Elsevier



## INTERNET LINKS

- <http://www.slideshare.net/maryline1979/medication-error-25474916>
- <http://www.study.com/academy/lesson/what-is-pharmacokinetics-definition-principles.html>