

Chemistry in Everyday Life

SYNOPSIS

- According 'WHO', a drug is defined as a substance or product which is used or intended to be used for modifying or exploring physiological systems or pathological states for the benefit of the recipient.
- They interact with targets and produce biological response.
- The drugs which produce therapeutic and useful biological response are called medicine.
- Chemotherapy is the use of chemicals for the therapeutic effect.

Classification of drugs

➤ A) Based on Pharmacological effect

- This classification is useful for doctors. Because the whole range of drugs available for the treatment of a particular type of problem.

Ex: (i) Analgesics have pain killing effect.

(ii) Antiseptic kills or inhibits growth of micro organisms.

➤ B) Based on drug Action

- They were classified as antihistamines, cardiovascular drugs, sedatives, hypnotics.
- In living organism histamine is synthesized from the naturally occurring α amino acid histidine by the loss of carboxyl group through bacterial (or) enzymatic decarboxylation.
- Histamine causes inflammation in the body.
- All antihistamines inhibit the action of histamine in different ways.

➤ C) Based on Molecular targets

- Drugs having same structural features will have same physiological and pharmacological effect.

Ex: Morphine, Heroin and Codeine have same structural features and relieve from pain and produce sleep.

➤ D) Based on Molecular targets

- Usually drugs interact with biomolecules such as lipids, carbohydrates, proteins, nucleic acids called target molecules.
- Drugs possessing common structural features may have same mechanism of action on targets.

Therapeutic action of different kinds of drugs

Antacids

- Chemicals that remove the excess acid in the stomach and maintain the excess acid in the stomach and maintain the P^H to normal level are called antacids.
Ex: $MgCO_3$, $AlPO_4$; $NaHCO_3$, Magnesium trisilicate; omeprazol and lansoprazole.
- A mixture of $Al(OH)_3$ and $Mg(OH)_2$ or $NaHCO_3$ can be used as antacids as they neutralize the acids.
- **Limitation of $NaHCO_3$** : Excess of $NaHCO_3$ makes the stomach alkaline and trigger the over production of acids.

Tranquilizers

- Sedatives are drugs that at exert a quieting effect accompanied by relaxation and rest but need not necessarily induce sleep.
- Barbituric acid, Luminal, Seconal, Valium Serotonin 520 etc., are the different types of tranquilizers.
- The sedatives and hypnotics are broadly classified into barbiturates and non barbiturates.

Barbiturates

- These are substituted pyrimidine derivatives.
- The pH of barbituric acid ranges from 5.4 to 5.9
- Barbituric acid has no central nervous system (CNS) activity but its alkenyl and /or aryl derivatives have CNS activity.
- The general structure of barbiturates are

Diagram

- **Analgesics:** They reduce or abolish pain. Without causing disturbance of nervous system like impairment of consciousness, mental confusion, incoordination, paralysis etc. Analgesics are classified into two types

Non Narcotic Analgesics (Non-Addictive Analgesics)

- These acts as analgesics without any addictive properties.
- The most commonly used analgesics are salicylates, aniline and aminophenol analogues pyrazolones and quinoline derivatives.
- **Aspirin:** (Mol.wt = 180; $C_9H_8O_4$)
- It is acetyl salicylic acid (or) salicylic acid acetate (or) O – acetyl salicylic acid.
- It was first prepared by Kolbe by refluxing salicylic acid with a mixture of acetic anhydride or acetic acid in the presence of H_2SO_4 (conc).

- It prevents blood clotting hence can be used for the prevention of heart attacks.
- **IBUPROFEN:** Chemically it is α methyl-4 (2 methyl propyl) benzene acetic acid.
- In its preparation from isobutyl benzene the following steps were involved.

Uses

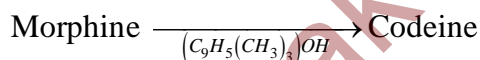
- It can be used as an anti-inflammatory, antipyretic and analgesic.
- It can be used for the treatment of rheumatoid arthritis and osteoarthritis.
- **Narcotic analgesics:** Alkaloids like morphine, codeine, papaverine and heroin are commonly used as narcotic drugs (opiates).
- Morphine narcotics are called as opiates as they are obtained from opium poppy.
- These relieve pain by acting on the central nervous system and produce sleep. Hence they are used for the relief of post-operative pain, cardiac pain, pains of terminal cancer and in child birth.

Morphine

- i) On acetylation of one of the phenolic groups gives heroin.
- ii) It can be used to
 - Check diarrhea
 - Ease dyspnea
 - Suppress cough
 - Induce sleep in the presence of pain

Codeine

- i) It is a homologue and methyl derivative of morphine.
- ii) It can be obtained by methylation of one of the phenolic groups of morphine with trimethyl ammonium hydroxide.



Antipyretics

- Cohn and Hepp first time identified the antipyretic action of aniline and acetanilide.

Paracetamol

- Its IUPAC name is N-acetyl para aminophenol (Mol. wt = 151; $\text{C}_8\text{H}_9\text{O}_2\text{N}$).
- Chemically it is 4-hydroxy acetanilide or N-(4-hydroxy phenyl) acetamide.
- Paracetamol is a better drug than aspirin.

Advantage

- It can be used for aspirin sensitive patients.

Phenacetin

- Chemically it is [N-(4-ethoxyphenyl)] acetamide.
- It can be used as analgesic and antipyretic.

Analgin

- Chemically it is sodium 1,5-dimethyl-4-(3-oxo-2-phenyl-2,3 dihydro-1H-4 pyrazo-1 oyl-(methyl) – aminomethane sulphonate.
- It consists of a phenyl hydrazine and ethyl acetoacetate units.
- It can be used as antipyretic and analgesic.

Antimicrobials

- Antimicrobials destroy/prevent the development (or) inhibit the pathogenic action of microbes such as bacteria, fungus, virus and other parasites.
- Antibiotics, antiseptics and disinfectants are antibacterial (or) antimicrobial drugs.
- Lysozyme is an enzyme present in tears, nasal secretion and saliva is useful in splitting lipids.
- A drug that kills microorganism in the body.
- A drug which inhibits the growth of organism.

Antibiotics:

- According to Benedict and Langlykke antibiotic is derived (or) produced by a living organism which is capable in small concentrations inhibiting the life process of micro-organism.
- Antibiotics are two types:
 - i) **Bactericidal:** They kill the microbes.
Ex: penicillin, amino glycosides, ofloxacin.
 - ii) **Bacteriostatic:** They inhibit the growth of microbes.
Ex: Erythromycin, Tetracycline, Chloramphenicol.

Penicillin

- The first antibiotic discovered by Fleming (1929) is penicillin.
- It is a mixture of natural compounds having molecular formula $C_9H_{11}O_4N_4SR$
- Depending on the nature of R there are three types of penicillins if
 - R = pent – 2 – enyl ---- penicillin I or F
 - R = $-CH_2 - C_6H_5$ benzyl penicillin (or) penicillin II or G
 - R = $- CH_2 - C_6H_4$ -----n-heptyl penicillin
 - R = $- (CH_2)_4 - CH_3$ -----amyl penicillin
 - R = $- CH_2 - O - C_6H_5$ penoxymethyl – penicillin
- **Sulphadiazine**
- Sulphadiazine is a sulpha drug
- It has a benzene ring and a heterocyclic aromatic 6 membered ring.

- Its molecular formula is $C_6H_{10}N_4SO_2$
- **Spectrum:** The complete range of micro organism that can be killed by a particular antibiotic is known as spectrum.
- **Broad spectrum antibiotics**
 - i) These kill or inhibit a wide range of gram-positive and gram-negative bacteria.
Ex: Synthetic modifications of penicillins like ampicillin and amoxicillin, chloramphenicol, vancomycin, ofloxacin and dysidazirine.
 - ii) Chloramphenicol is rapidly absorbed from gastrointestinal from hence it can be given orally for typhoid, dysentery, acute fever meningitis, pneumonia and for urinary infections.
- **Narrow spectrum antibiotics:** These will kill (or) inhibit either gram positive or gram negative bacteria. Ex: penicillin-G
- **Limited spectrum antibiotics:** These are effective against a single organism or disease.
- **Antiseptics:** These are applied to the living tissues such as wounds, cuts, ulcers and diseased surface. These are for external use only. Cannot be ingested like antibiotics

Ex:

1. Dettol – a mixture of chloroxylenol and terpineol
 2. Tincture of Iodine-2-3% solution of I_2 in alcohol-water mixture.
 3. 4% aq solution of formaldehyde is called formalin
 4. Formalin is used (i) as disinfectant (ii) Preservation of biological specimens
- **Disinfectants:** These are applied to floors drainage aystem, and such inanimatate objects.

Ex:

- i) 0.2% phenol can acts as antiseptic while 1% phenol is disinfectant.
- ii) 0.2-0.4% chlorine water and SO_2 in very low concentrations can be used as disinfectants.

Antifertility Durgs

- These are compounds of progesterone and estrogen hormones:
Ex:
 - i) Northindrone is progesterone derivative
 - ii) Ethynylestradio (novestrol) is estrogen derivative.
- Mifepristone is a synthetic steroid that blocks the effects of progesterone. Hence it is a constituent of morning after pill.
- Progesterone suppresses ovulation.

Chemical in food

- Chemicals are added to food for their,
 - i) Preservation
 - ii) Enhancing appeal
 - iii) Increasing nutritive value

Anti oxidants

- Retard the action of oxygen of food since they are more reactive towards oxygen than the food materials.
- They reduce the rate of involvement of free radicals in the aging process
- Generally used anti oxidants are butylated hydroxyl toluene (BHT) and butylated hydroxyl anisole (BHA)
- Food dyes have no nutritive value but sometimes are harmful particularly for children, asthma patients etc.
- **Food preservatives:** These prevent spoilage of food due to microbial growth, Ex: NaCl, Sugar, Vegetable oils, salts of sorbic acid & propionic acid. C_6H_5COONa also finds limited use as it is metabolised by the body.

Artificial sweetening agents

- Natural sweeteners like sucrose not only gives sweetness but also adds calories. Therefore the diabetic patients prefer to use artificial sweeteners instead of sucrose.
- **Ortho-sulphobenzamide:** is called saccharine. It is 550 times sweeter than cane sugar. It is harmless unlike sucrose.
- **Aspartame** is 100 times sweeter than cane sugar.
- **Alitame:** is high potency sweetener which is thousand times sweeter than sucrose and more stable than aspartame.
- **Sucrolose:** is trichloro derivative of sucrose. It is stable even at cooking temperatures. It cannot provide calories. Its appearance and taste are like sugar.