Chemistry in Everyday Life

Drugs: Chemicals of low molecular masses (~100–500 u) used to produce biological response by interacting with target macromolecules. Drugs used for therapeutic effect are called medicines. Chemotherapy refers to the use of chemicals for therapeutic effect.

Classification of drugs

(i) Based on pharmacological effect

Useful for doctors as it provides the whole range of drugs available to cure a particular type of problem.

(ii) Based on drug action

On the basis of action of a drug on a particular biochemical process.

(iii) Based on chemical structure

(iv) Based on molecular targets

(i) Useful for medicinal chemists

(ii) Target molecules or molecular targets are the biomolecules with which drugs interact. For example, carbohydrates, lipids, proteins and nucleic acids.

Drug-Target interaction:

(A) Enzymes as drug targets

(1) Catalytic action of enzymes

Two major functions of enzymes are:

(i) Substrate molecules are held in suitable positions by active sites of enzymes through ionic bonding, H-bonding, van der Waals interaction or dipole–dipole interaction.

(ii) To attack the substrate molecules, functional groups are provided by enzymes.

(2) Drug-enzyme interaction

Drugs inhibit the catalytic action of enzyme by blocking the binding site of enzyme. Such drugs are called enzyme inhibitors.

The two ways of drug enzyme interaction are:

(i) Drugs compete with substrate molecules to attack on the active sites of enzymes. Such drugs are called competitive inhibitors.

(ii) Some drugs change the shape of the active site of enzyme by binding to a different site not to

the active site of enzyme so that substrate cannot recognize it. This site is called allosteric site.

(B) Receptors as drug targets

(i) Receptors are proteins that are crucial to communication process of body.

(ii) Chemical messenger are chemicals through which message between two neurons and that between neurons to muscles is communicated.

(iii) Antagonists are drugs which inhibit natural function of receptor by binding to its site.

(iv) Agonists are drugs that mimic the natural messenger by switching on the receptor.

Therapeutic action of different classes of drugs:

Antacids

(i) Used for the treatment of acidity.

(ii) Metal hydroxides are generally used as antacids.

Antihistamines

Drugs

(i) Cimetidine and ranitidine prevent the interaction of histamine with the receptors present in the stomach wall and as a result lesser amount of acid is released.

(ii) Antihistamine drugs – brompheniramine (Dimetapp), terfenadine (Seldane). They interfere with the natural action of histamine by competing with histamine for finding sites of receptors.

(iii) Antihistamines do not affect the secretion of acid in stomach.

Neurologically active drugs

They affect the mechanism of message transfer from nerve to receptor.

(a) Tranquilizers

(i) Used for the treatment stress and mental diseases

(ii) Antidepressant drugs are used when a person is suffering from depression. E.g. iproniazid, phenelzine.

(iii) Barbiturates constitute an important class of tranquilizers.

(b) Analgesics– Used to reduce pain.

Two types –

(i) Non-narcotic (non-addictive) analgesics: Example: Asprin

(ii) Narcotic drugs: Example: Morphine and many of its homologues

Antimicrobials: Inhibit the pathogenic action of microbes such as bacteria, fungi, virus or other parasites. Examples – Antibiotics, antiseptics, disinfectants.

(a) Antibiotics

(i) Used to treat infections

(ii) Penicillin is an antibacterial drug

(iii) Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are called broad spectrum

antibiotics. Ampicillin and amoxicillin which are synthetic modifications of penicillin are broad spectrum antibiotics.

(iv) Chloramphenicol is a broad spectrum antibiotic which is used orally for treatment of typhoid, dysentery, acute fever

pneumonia. Vancomycin and ofloxacin are broad spectrum antibiotics.

(v) Antibiotics which are effective mainly against Gram-positive or Gram-negative bacteria are called narrow spectrum

antibiotics. E.g. Penicillin G.

(vi) Antibiotics which are effective against a single organism or disease are called limited spectrum antibiotics.

(b) Antiseptics and disinfectants: Chemicals which kill or prevent the growth of microorganisms.

(i) Antiseptic are applied to living tissues such as wounds, cuts, ulcers, diseased skin surfaces while disinfectants are applied to

inanimate objects such as floors, drains, instruments etc.

(ii) **Examples of antiseptics:** Furacine, soframicine, dettol (mixture of chloroxylenol and terpineol), tincture of iodine (2-3%) solution of iodine in alcohol-water mixture), iodoform, basic acid in dilute aqueous solution (weak antiseptic for eyes).

(ii) **Examples of disinfectants:** 0.2 to 0.4 ppm of chlorine in aqueous solution, sulphur dioxide in low concentration. 0.2% solution of phenol is used as antiseptic while 1% solution of phenol is used as disinfectant.

Antifertility drugs: Used in the direction of family planning. E.g. norethindrone, ethynylestradiol (novestrol).

Chemical in food:

Artificial sweetening agents: They are required to control intake of calories. E.g. aspartame,

saccharin, sucrolose, alitame

Food preservatives: Table salt, sugar, vegetable oils, sodium benzoate (C_6H_5COONa) etc

Cleansing agents

(I) Soaps: Soaps are sodium or potassium salts of long chain fatty acids, e.g., stearic, oleic and palmitic acid.

Saponification: Reaction of forming sodium salts by heating fat (i.e. glyceryl ester of fatty acid) with aqueous solution of sodium hydroxide.

Soaps in hard water

(i) Hard water contains calcium and magnesium ions.

(ii) Soaps do not work in hard water because they react with calcium and magnesium ions to form scum.

(II) Synthetic detergents: Can be used both in soft and hard water.

(i) **Classification**

Anionic detergents: Sodium salts of sulphonated long chain alcoholsor hydrocarbons.

Cationic detergents Quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

Non-ionic detergents: Do not contain any ion in their constitution.

(ii) Detergents with straight chain hydrocarbons are biodegradable while those with branched chain hydrocarbons are non-biodegradable.