Chemistry in Everyday Life

16 Chapter

1 SOME IMPORTANT TERMS

- **Drugs** : Drugs are chemicals of low molecular masses (100-500u). These interact with macromolecular targets and produce a biological response. When the biological response is therapeutic and useful, these are called medicines.
- **Enzymes :** Proteins which perform the role of biological catalysts in the body are called enzymes.
- **Receptors :** Proteins which are crucial to communication system in the body are called receptors.
- **Enzyme inhibitors:** Drugs can block the binding site of the enzyme and prevent the binding of substrate, or can inhibit the catalytic activity of enzyme. Such drugs are called enzyme inhibitors
- **Competitive inhibitors :** Drugs compete with natural substrate for their attachment on the active sites of enzymes. Such drugs are called competitive inhibitors.
- **Allosteric site :** Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called allosteric site.
- **Chemical messengers :** In human body, message between two neurons and that between neurons to muscles is communicated through certain chemicals. These are called chemical messengers.
- **Antagonists :** Drugs that bind to the receptor site and inhibit its natural function are called antagonists.
- **Agonists :** Drugs that mimic the natural messenger by switching on the receptor are called agonists.

2 THERAPEUTIC ACTION OF DIFFERENT CLASSES OF DRUGS

(i) **Antacids :**
- Over production of acid in the stomach causes irritation and pain
- Histamine stimulates the secretion of pepsin and HCl in the stomach
- Antacids prevent the interaction of histamine with receptors present in the stomach wall. This results in the release of lesser amount of acid.

Examples of antacids :
Cimetidine (Tegamet), ranitidine (Zantac)

(ii) **Antihistamines :**
- Histamine is a potent vasodilator
- Histamine is also responsible for the nasal congestion associated with common cold and allergic response to pollen
- Synthetic drugs, brompheniramine (Dimetapp) and terfenadine (Seldane), act as antihistamines

(iii) **Neuologically active drugs :**
Tranquilizers and analgesics are neurologically active drugs. These affect the message transfer mechanism from nerve to receptor.

(a) **Tranquilizers :**
- These drugs are used for the treatment of stress, and mild or even severe mental diseases.
- These relieve anxiety, stress, irritability or excitement by inducing a sense of well being.
- They form an essential component of sleeping pills.
- **Examples are :** Iproniazid, phenelzine (Nardil), Meprobamate, Chlordiazepoxide, Equanil
- Derivatives of barbituric acids also constitute important class of tranquilizers.
  Examples: Veronal, amytal, nembutal, luminal and seconal

(b) **Analgesics :** These drugs reduce or abolish pain. These are of two types
(i) **Non-narcotic analgesics :** These drugs inhibit synthesis of prostaglandins which stimulate inflammation in the tissue and cause pain.
Examples: Aspirin and paracetamol
(ii) **Narcotic analgesics:**
- Morphine when administered in medicinal dose, relieve pain and produce sleep.

(iv) **Antimicrobials :**
- An antimicrobial destroy/prevent development or inhibit the pathogenic action of microbes such as bacteria, fungi, virus, parasites selectively
- Antibiotics, antiseptics and disinfectants are antimicrobial drugs

(A) **Antibiotics :** Antibiotics are used as drugs to treat infections because of their low toxicity for humans and animals.
- Arsphenamine also known as salvarsan was used to treat syphilis caused by bacteria spirochete.
- Antibiotics are of two types :
  (a) **Bactericidal :** These antibiotics have killing effect on microbes
  Examples: Penicillin, Aminoglycosides, Ofloxacin
  (b) **Bacteriostatic :** These antibiotics have inhibitory effect on microbes.
  Examples : Erythromycin, Tetracycline, chloramphenicol
- Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be **broad spectrum antibiotics**.
  Examples: Ampicillin, Amoxycillin, Chloramphenicol, vancomycin, ofloxacin.
- Antibiotics effective mainly against Gram-positive or Gram-negative bacteria are **narrow spectrum antibiotics**.
  Example: Penicillin G

(B) **Antiseptics and disinfectants**
(a) **Antiseptics:** These are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces.
Examples: Furacine, soframicine
- Dettol is a mixture of chloroxylenol and terpineol.
- Bithional is added to soaps to impart antiseptic properties.
- 2-3 per cent solution in alcohol-water mixture is known tincture of iodine. It is applied on wounds.
- Boric acid in dilute aqueous solution is weak antiseptic for eyes.
- 0.2 per cent solution of phenol is an antiseptic.

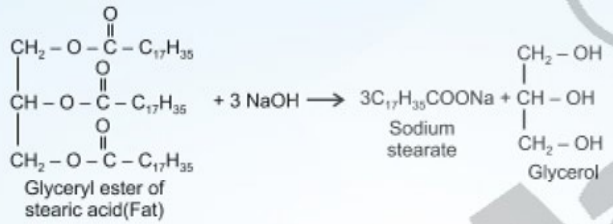
(b) **Disinfectants :**
- These are applied to inanimate objects such as floors, drainage system, instruments etc.
- 1% solution of phenol is used as disinfectant
- Chlorine in the concentration of 0.2 to 0.4 ppm in aqueous solution and SO_2 in very low concentrations, are disinfectants.

(v) **Antifertility drugs :**
- Antifertility drugs are used to control birth in human beings.
- Birth control pills essentially contain a mixture of synthetic estrogen and progesterone derivatives.
- Norethindrone and novestrol are used as antifertility drugs.

(4) CLEANSING AGENTS

Two types of detergents are used as cleansing agents.

(i) **Soaps :**
- Soaps are sodium or potassium salts of long chain fatty acids.
- Soaps containing sodium salts are formed by heating fat with aqueous NaOH. This reaction is called saponification



Glyceryl ester of stearic acid(Fat)

(ii) **Synthetic Detergents :** These are cleansing agents which have all the properties of soaps, but can be used both in soft and hard water.
- These are of three types

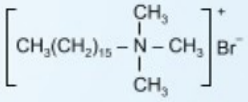
(a) **Anionic detergents :** Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons.

Examples : Sodium laurylsulphate $(CH_3(CH_2)_{10}CH_2OSO_3^-Na^+)$,

Sodium dodecylbenzene sulphonate

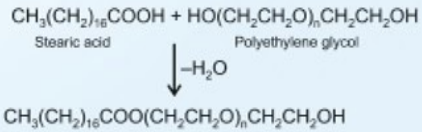
(b) **Cationic detergents :** Cationic detergents are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

Example : Cetyltrimethyl ammonium bromide



(c) **Non-ionic detergents :** Non-ionic detergents do not contain any ion in their constitution.

Examples : Detergent formed when stearic acid reacts with polyethylene glycol.



- Liquid dishwashing detergents are non-ionic type
- Detergents and soap remove grease and oil by micelle formation

(3) CHEMICALS IN FOOD

(i) **Artificial sweetening agents :** Natural sweeteners, e.g., sucrose add to calorie intake and therefore many people prefer to use artificial sweeteners.

	Artificial sweetener	Sweetness value in comparison to cane sugar
(a)	Aspartame	100
(b)	Saccharin	550
(c)	Sucralose	600
(d)	Alitame	2000

- Aspartame is limited to cold foods and soft drinks because it is unstable at cooking temperature.
- Alitame is high potency sweetener. It is more stable than aspartame.
- Sucralose is trichloro derivative of sucrose. It is stable at cooking temperature.

(ii) **Food preservatives:**
- Food preservatives prevent spoilage of food due to microbial growth.

Examples : Table salt, sugar, vegetable oils, C_6H_5COONa etc.

(iii) **Antioxidants in Food**
- These help in food preservation by retarding the action of oxygen on food.
- These are more reactive towards oxygen than food materials which they are protecting.
- Butylated hydroxytoluene (BHT) and butylated hydroxy anisole (BHA) are most familiar antioxidants.
- SO_2 and sulphite are useful antioxidants for wine and beer, sugar syrups and cut, peeled or dried fruits and vegetables.

Sharpen Your Understanding

1. Which among the following is an antacid? [NCERT Pg. 451]
   (1) Ranitidine
   (2) Serotonin
   (3) Terfenadine
   (4) Histamine
2. Dimetapp is an [NCERT Pg. 451]
   (1) Antihistamine
   (2) Analgesic
   (3) Antipyretic
   (4) Antibiotic
3. Consider the following statements [NCERT Pg. 447,453,448]
   (a) Use of chemicals for therapeutic effect is called chemotherapy
   (b) Analgesics have pain killing effect
   (c) Proteins which perform the role of biological catalysts in the body are called enzymes
   The correct statements are
   (1) (a) and (b) only (2) (b) and (c) only
   (3) (a) and (c) only (4) (a), (b) and (c)
4. Which among the following is a bactericidal antibiotic? [NCERT Pg. 455]
   (1) Tetracycline (2) Ofloxacin
   (3) Chloramphenicol (4) Erythromycin

NCERT Based MCQs

5. The compound which contains heterocyclic ring is [NCERT Pg. 454,455,456]
   (1) Salvarsan (2) Prontosil
   (3) Penicillin (4) Norethindrone
6. Sweetest compound among the following is [NCERT Pg. 457]
   (1) Sucrose (2) Saccharin
   (3) Aspartame (4) Sucralose
7. Select the incorrect match [NCERT Pg. 456,455,458,452]

	Column I	Column II
(1)	Novestrol	Antifertility drug
(2)	Chloramphenicol	Broad spectrum antibiotic
(3)	Alitame	Artificial sweetener
(4)	Meprobamate	Analgesic

8. Incorrect statement among the following is [NCERT Pg. 453,451,452]
   (1) Aspirin inhibits the synthesis of prostaglandins
   (2) Morphine when administered in medicinal dose, relieve pain
   (3) Veronal is a derivative of barbituric acid
   (4) Antihistamines and analgesics are neurologically active drugs
9. The compound which is unstable at cooking temperature is [NCERT Pg. 458]
   (1) Aspartame
   (2) Sucralose
   (3) Saccharin
   (4) Sucrose
10. Dettol is a mixture of [NCERT Pg. 456]
    (1) Chloroxylenol and furacine
    (2) Bithionol and soframycine
    (3) Chloroxylenol and terpineol
    (4) Terpineol and furacine
11. Consider the following statements [NCERT Pg. 458]
    (a) Sodium benzoate is used as food preservative
    (b) BHT is used as an antioxidant
    (c) Liquid dishwashing detergents are cationic detergents
    The incorrect statement(s) is/are
    (1) (a) and (c) only
    (2) (c) only
    (3) (b) only
    (4) (b) and (c) only

12. Incorrect statement among the following is [NCERT Pg. 452,453,451]
(1) Noradrenaline plays role in mood changes
(2) Barbiturates are hypnotic
(3) Histamine is responsible for nasal congestion
(4) Drugs that bind to the receptor site and inhibit its natural function are called agonists

13. Narrow spectrum antibiotics among the following is [NCERT Pg. 455]
(1) Penicillin G (2) Vancomycin
(3) Ofloxacin (4) Chloramphenicol

14. Norethindrone is used as [NCERT Pg. 456]
(1) Antifertility drug
(2) Antiseptic
(3) Tranquilizer
(4) Analgesic

15. In which of the following compounds tertiary amine is absent? [NCERT Pg. 453]
(1) Morphine
(2) Serotonin
(3) Heroin
(4) Codeine

16. Which among the following is not used as a tranquilizer? [NCERT Pg. 452,453,455]
(1) Meprobamate (2) Equanil
(3) Dysidazirine (4) Veronal

17. Which among the following is present in salvarsan? [NCERT Pg. 454]
(1) As (2) Cd
(3) Pb (4) Ag

18. Saccharin is sweeter than cane sugar by how many times? [NCERT Pg. 457]
(1) 100 (2) 600
(3) 550 (4) 2000

19. Consider the following statements [NCERT Pg. 459,460]
(a) Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons
(b) Cetyltrimethyl ammonium bromide is a cationic detergent
(c) Calcium stearate is soluble in water but sodium stearate is not
The incorrect statement(s) among the following is/are
(1) (b) only (2) (c) only
(3) (a) and (b) only (4) (b) and (c) only

20. Which solution is used as disinfectant? [NCERT Pg. 456]
(1) Tincture of iodine
(2) Aqueous solution of boric acid
(3) 0.2 percent solution of phenol
(4) 0.2 to 0.4 ppm solution of Cl_2

Thinking in Context

1. Use of chemicals for therapeutic effect is called _____. [NCERT Pg. 447]

2. Proteins which are crucial to communication system in the body are called _____. [NCERT Pg. 448]

3. Some drugs do not bind to the enzyme's active site. These binds to a different site of enzyme which is called _____ site [NCERT Pg. 449]

4. Receptor proteins are embedded in _____ [NCERT Pg. 450]

5. _____ stimulates the secretion of pepsin and hydrochloric acid in the stomach [NCERT Pg. 451]

6. Synthetic drug, terfenadine acts as _____ [NCERT Pg. 451]

7. Tranquilizers affect the message transfer mechanism from _____ to receptor [NCERT Pg. 452]
8. Antidepressant drugs inhibit the enzymes which catalyse the degradation of _____ [NCERT Pg. 452]
9. Equanil is used in controlling depression and _____ [NCERT Pg. 452]
10. Nembutal is a derivative of _____ [NCERT Pg. 453]
11. Aspirin and paracetamol belong to the class of _____ analgesics [NCERT Pg. 453]
12. Aspirin inhibits the synthesis of _____ [NCERT Pg. 453]
13. In body, prontosil is converted to a compound called _____ [NCERT Pg. 455]
14. Ampicillin and Amoxycillin are synthetic modifications of _____ [NCERT Pg. 455]
15. _____ is added to soaps to impart antiseptic properties [NCERT Pg. 456]
16. _____ percent solution of phenol is an disinfectant [NCERT Pg. 456]
17. Birth control pills essentially contain a mixture of synthetic _____ and _____ derivatives [NCERT Pg. 456]
18. Aspartame is methyl ester of dipeptide formed from _____ and phenylalanine [NCERT Pg. 458]
19. Sucralose is trichloro derivative of _____ [NCERT Pg. 458]
20. Hydrolysis of glyceryl ester in presence of alkali is known as _____ [NCERT Pg. 459]

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