

16. CHEMISTRY IN EVERYDAY LIFE

There is no aspect of our life that is not affected by the developments in chemistry; in fact chemistry plays a very important role in our everyday life.

CHEMICALS IN MEDICINES

DRUGS

- A **drug** is a chemical agent, which affects human metabolism and provides cure from diseases.

Distinction between *medicine* and *drug*

- **Medicine** is a chemical which cures the disease, is safe of use, has negligible toxicity and do not cause addiction.
- **Drug** cures the disease, but is habit forming, causes addiction and has serious side effects.

- Use of chemicals in treatment of disease is called **chemotherapy**.

Action of Drugs

- **Drug chemistry** centers on arresting microbes/destroying microbes, preventing the body from various infectious diseases, releasing mental stress, etc.

For this, drugs inhibit *activity of enzyme* of that particular metabolism, in 2 different ways-

1. Competitive inhibition

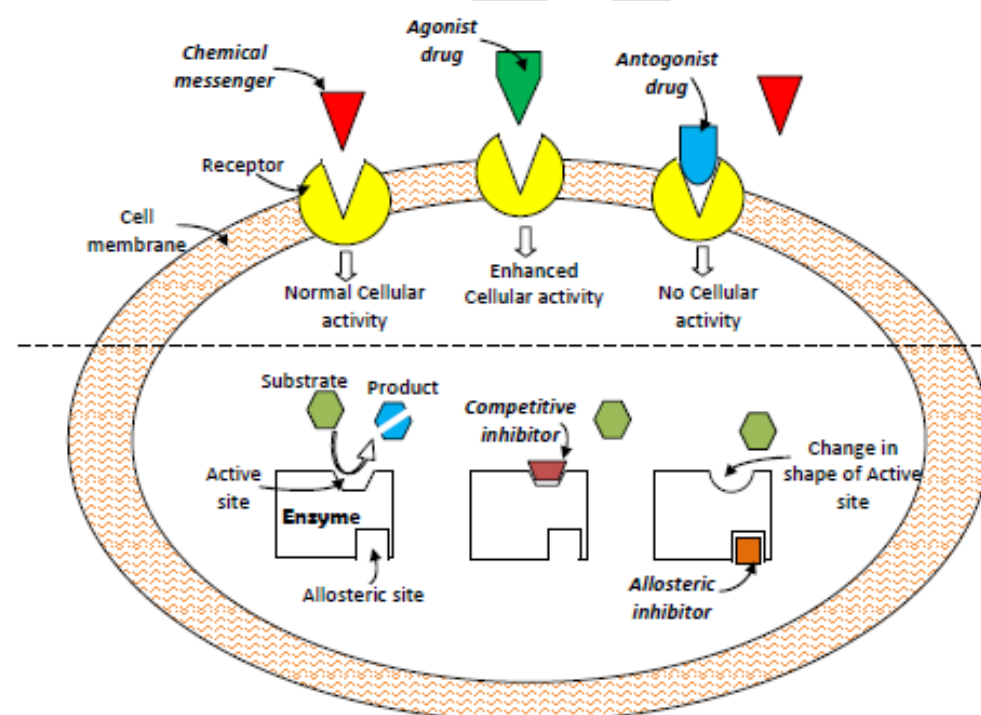
Drugs, closely similar to the natural *substrate/ chemical messenger*, **compete** for their attachment on the active sites of enzymes / receptors. Such drugs are called **competitive inhibitors**.

2. Allosteric inhibition

Some drugs binds to different site of *enzyme / receptors* (**allosteric site**) which changes the shape of active site in such a way that *substrate/ chemical messenger* cannot recognize it.

There are certain drugs that inhibit or enhance *activity of receptors* on the cell where the particular metabolism occurs-

1. Drugs that bind to the receptor site and inhibit the natural function of *messengers* are called **antagonists**. (These are useful when blocking of message is required).
2. Drugs that mimic the natural messenger by switching on the receptor, these are called **agonists**. (These are useful when there is lack of natural chemical messenger).



Classes of Drugs based on pharmacological effect

Class	Definition	Action	Examples
I- Antacids	Drugs which reduce the secretion of acid in the stomach and give relief from ulcer.	Prevent the interaction of histamine (which stimulate the secretion of HCl) with the receptors present in the stomach wall.	Cimetidine (Tegamet), Ranitidine (Zantac)
II- Antihistamines	Drugs which inhibits the action of allergy causing histamines.	Interfere the action of histamine by competing with it for binding sites of receptor where histamine exerts its effect.	Brompheniramine (Dimetapp), terfenadine (Seldane)
III- Tranquilizers	Drugs used for the treatment of stress and mental diseases.	Inhibit the enzymes which catalyse the degradation of <i>noradrenaline</i> (neurotransmitters that overcome stress).	Iproniazid } anti-depressants Phenelzine } Chlordiazepoxide } relieve tension Meprobamate } Equanil } Veronal, Amytal, } hypnotic/ Nembutal, } sleep inducing Numinal Seconal }
IV- Analgesics	Drugs which reduce pain	Based on action, analgesics are classified as- ○ Non-narcotic (non-addictive) - Inhibits the synthesis of <i>prostaglandins</i> (which stimulate inflammation in the tissue and cause pain). ○ Narcotic - Relieve pain and produce sleep.	Aspirin (also prevent heart attack), Paracetamol (<i>antipyretic, i.e., reduce fever</i>) Morphine, Heroin, Codeine.

V- Antibiotics	Kill or retard the growth of microorganisms	Based on action, antibiotics are 2 types - <div> <div></div> <div>Bactericidal (kill the microbe)</div> </div> <div> <div></div> <div>Bacteriostatic (inhibit or arrest the growth of microbe)</div> </div>	Penicillin, Aminoglycosides, Ofloxacin Erythromycin, Tetracycline, Chloramphenicol
✓ Based on spectrum (range of microorganisms attacked), antibiotics are classified as:- <ul style="list-style-type: none"> ○ Broad spectrum (effective against a wide range of bacteria)- <i>E.g.: Chloramphenicol, ofloxacin, Ampicillin and Amoxycillin</i> ○ Narrow spectrum antibiotics- <i>E.g.: Penicillin</i> ○ Limited spectrum antibiotics (effective against a single bacteria)- <i>E.g.: Dysidazine</i> 			
VI- Antiseptics	Arrest the growth of microorganisms on living tissues such as wounds, cuts and skin disease.		Dettol (a mixture of chloroxylenol and terpineol), Bithionol (in soaps), Iodoform (for wounds), Dilute Boric acid (for eyes), Phenol (0.2%).
VII- Disinfectants	Kill or arrest the growth of microorganisms on floors, drains, toilet, instruments, etc.		Phenol (1%), chlorine (0.2-0.4 ppm- for sterilizing water), SO ₂
VIII- Antifertility drugs	Used to check pregnancy in women.	Prevent menstrual cycle or suppresses ovulation	Norethindrone (synthetic progesterone), ethynylestradiol (novestrol: estrogen- progesterone combination)

CHEMICALS IN FOOD

Food additives such as preservatives, sweetening agents, flavours, antioxidants, edible colours and nutritional supplements are added to the food to make it attractive, palatable and add nutritive value.

A- Preservatives

- ❖ **Preservatives** are chemicals which are used to prevent spoilage of food due to microbial growth.

Class I- E.g.: Table salt, sugar, vegetable oils

Class II- E.g.: Sodium benzoate, Salts of sorbic acid and propanoic acid

B- Artificial sweetening agents

- ❖ **Artificial sweeteners** are used by those who -

- need to check the calorie intake or
- as to substitute for sugar for diabetics

E.g.:

Artificial sweetener	Sweetness value in comparison to cane sugar	Remarks
Aspartame	100	It decompose at baking or cooking temperature and hence can only be used in cold foods and soft drinks
Saccharin	550	It is not biodegradable and does not have any calorific value (great value to diabetic persons)
Sucralose	600	Its appearance and taste are like sugar . It is stable at cooking temperature. It does not provide calories
Alitame	2000	More stable than aspartame , cannot control of sweetness of food

C- Antioxidants

- ❖ **Antioxidants** prevents oxidation and subsequent spoilage of food. They also reduce the rate of involvement of free radicals in the ageing process.

E.g.: Butylated Hydroxy Toluene (BHT), Butylated Hydroxy Anisole (BHA)

CLEANSING AGENTS

Cleaning agents improve cleansing properties of water.

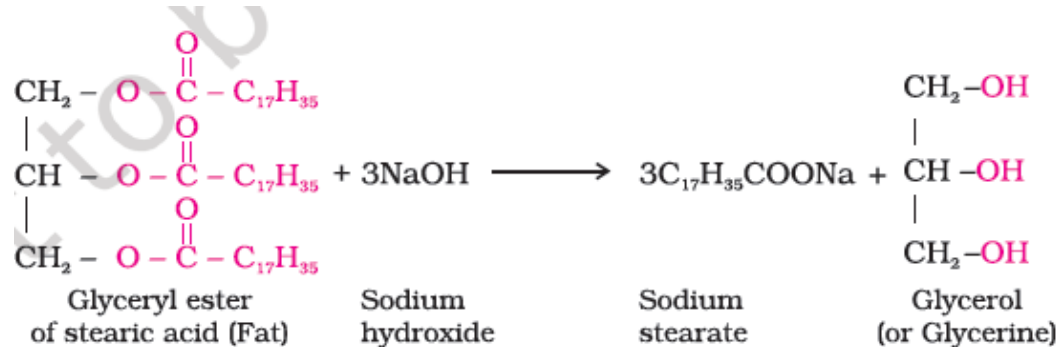
There are 2 types of cleansing agents- **soaps** and **detergents**.

A- Soaps

- **Soaps** are sodium or potassium salts of long chain fatty acids. Soaps containing sodium salts are formed by heating fat (*i.e.*, glyceryl ester of fatty acid) with aqueous sodium hydroxide solution. This reaction is known as **saponification**.

OR

Saponification is the hydrolysis of fats by alkali. This results in the formation of glycerol and salts of fatty acids which are called **soap**.



Types of soaps-

1. **Toilet soaps** are prepared by using fats and oils and care is taken to remove excess alkali.
2. **Floating soaps** are made by beating tiny air bubbles before their hardening.
3. **Transparent soaps** are made by dissolving the soap in ethanol and then evaporating the excess solvent.
4. **Medicated soaps** contain some substance of medicinal value
5. **Shaving soaps** contain **glycerol** (to prevent rapid drying) and **rosin** (a gum which lathers well)
6. **Laundry soaps** contain fillers like sodium rosinate, sodium silicate, borax and sodium carbonate.

Advantage of soaps-

- a) 100% biodegradable

Disadvantage of soaps-

- a) **Soaps do not work in hard water** since calcium and magnesium ions present in hard water produces insoluble salts (**scum**).



- b) Soaps cannot be used in acidic solution

B- Detergents

- **Detergents** are ammonium sulphonate or sulphate salts of long chain hydrocarbons.
- Synthetic detergents are classified into 3 categories:-

Class	Formation	Specific uses
1. Anionic detergent - Large anionic part of the molecule is involved in cleansing action. E.g.: Sodium alkylbenzene sulphonates.	Treating alcohols with concentrated sulphuric acid and is neutralised with alkali	<ul style="list-style-type: none"> ▪ To wash clothes. ▪ In toothpastes
2. Cationic - Large cationic part of the molecule is involved in cleansing action. E.g.: Cetyltrimethylammonium bromide	--	<ul style="list-style-type: none"> ▪ In hair conditioners ▪ In germicides
3. Non-ionic - Esters of high molecular mass alcohols. (Do not contain any ions)	Stearic acid reacts with polyethyleneglycol.	<ul style="list-style-type: none"> ▪ In dishwasher

Advantage of detergents-

- a) It can be used for cleaning work in hard water.

Disadvantage of detergents-

- a) Detergents having highly branched hydrocarbon chain are **not biodegradable** and hence cause water pollution. (to minimise pollution, branching of the hydrocarbon chain is kept to the minimum).

Cleansing action

Soap molecules form micelle around the dirt, hydrophobic part → in dirt, hydrophylic part → out of the dirt, like a bristles, polar group interact with water, dirt is pulled in water and removed.