

Drugs/medicines are the chemicals of low molecular masses used to cure the disease or reduce suffering from pain. When we use chemicals for therapeutic effect, then it is called chemotherapy. Drugs can be classified mainly on the criteria mentioned below:

- (a) pharmacological effect: It is useful for doctors because it provides them the whole range of drugs available for the treatment of a particular type of problem. For example, analgesics have pain killing effect, antiseptics are used for killing microorganism.
- (b) drug action: It is based on the action of a drug on a particular biochemical process. For example, all histamines which causes inflammation in the body can be inhibited by the action of antihistamines.
- (c) chemical structure: Drugs having common structural features often have similar pharmacological activity.
- (d) molecular targets: Drugs usually interact with biomolecules such as carbohydrates, lipids, proteins and nucleic acids. These are called target molecules or drug targets. Drugs possessing some common structural features may have the same mechanism of action on targets.

Classification of drugs on the basis therapeutic action

1. Antacids: These are chemicals which are weak bases used to neutralise the excess HCl produced in the stomach. Examples are NaHCO_3 , $\text{Mg}(\text{OH})_2$ (milk of magnesia), $\text{Al}(\text{OH})_3$.
 NaHCO_3 in excessive use can make the stomach alkaline and trigger the formation of even more acid.
 $\text{Mg}(\text{OH})_2$ and $\text{Al}(\text{OH})_3$ are better alternatives as they are insoluble and do not increase the pH above neutrality.
2. Analgesics reduces suffering from pain without causing impairment of consciousness, mental confusion or other disturbances of nervous system.

There are two types of analgesics:

(i) Non-narcotic: examples are aspirin, paracetamol.

These are non-addictive. These drugs are effective in relieving skeletal pain arising due to arthritis.

(ii) Narcotic: These analgesics are chiefly used for the relief of post-operative pain, cardiac pain and pains of terminal cancer, and in child birth.

Examples are morphine, heroin, codeine, cocaine.

3. Antipyretics are used to lower the body temperature in case of high fever. Examples: Aspirin, paracetamol, phenacetin.

Aspirin should not be taken empty stomach as it gets hydrolysed by acid to form salicylic acid which causes bleeding in the stomach and ulcer formation.

Aspirin prevents platelet coagulation. Aspirin is anti blood clotting agent and is used in preventing heart attacks.

4. Antiseptics and disinfectants

Antiseptics are the chemicals used to kill microorganisms without affecting the living human tissues. These are used in case of cuts, wounds, burns and bruises.

Examples: (i) Dettol (a mixture of chloroxylenol and terpineol),

(ii) Iodoform (CHI_3 , yellow powder) for wounds.

(iii) Tincture of iodine \rightarrow 2-5% solution of iodine in alcohol/water.

(iv) Boric acid (H_3BO_3) in dilute aqueous solution is a weak antiseptic for eyes.

(v) Bitthional is added to soaps to impart antiseptic properties.

Disinfectants are the chemicals which not only kill microorganisms but affect the living tissues also. They are used for inanimate objects. Same substance can act as an antiseptic as well as disinfectant depending on the concentration. Example:

phenol $\begin{cases} \rightarrow 0.2\% \text{ solution} \rightarrow \text{antiseptic} \\ \rightarrow 1\% \text{ solution} \rightarrow \text{disinfectant} \end{cases}$

5. Tranquilisers are the chemicals used for the treatment of stress, mild or even severe mental diseases. These are the components of sleeping pills, used for relieving tension, anxiety etc. These drugs affect the central nervous system and hence called psycho-therapeutic drugs.
Examples: (i) Equanil (used in controlling depression & hypertension)
(ii) secobarbital, luminal, veronal → hypnotic (sleep producing)
(iii) valium, serotonin

6. Antihistamines are anti-allergic drugs. These drugs are developed to prevent the interaction of histamines with the receptors. Examples: cimetidine, ranitidine → used as antihistamines and very effective in controlling the acidity in the stomach without any side effects.

Cough syrups also contains antihistamines.

Examples: brompheniramine, chlorpheniramine etc.
Antihistamines do not affect the secretion of acid in stomach as antiallergic and antacid drugs work on different receptors.

7. Antibiotics are the chemicals produced from microorganisms, used to kill other microorganisms. First antibiotic was prepared by Fleming. First antibiotic was penicillin.

There are two types of antibiotics:

(a) Bactericidal → which completely kills bacteria.
Examples: penicillin, ofloxacin.

(b) Bacteriostatic → which have static or inhibitory effect on microbes. Examples: Erythromycin, Tetracycline, Chloramphenicol

Antibiotics which can be used for more than one disease are called broad spectrum antibiotics. Examples are chloramphenicol, ampicillin, amoxycillin, ofloxacin.
Chloramphenicol is used for high fever, typhoid, dysentery, whooping cough.

Narrow spectrum antibiotics are effective against a single organism or disease. Example: Penicillin G

In India, antibiotics are produced by Hindustan Antibiotics Limited at Pimpri and at Haridwar.

Some sulpha drugs are also used as antibiotics. Examples are sulphathiazole (for TB), sulphapyridine.

8. Antifertility drugs are used to control population. These drugs contain synthetic female sex hormones like estrogen and progesterone, which suppress ovulation.
Examples: Norethindrone, ethinyl estradiol.

Drug Action

Enzymes are proteins which act as a biological catalysts. Enzymes which are crucial to communication system in the body are called receptors.

Catalytic action of enzymes

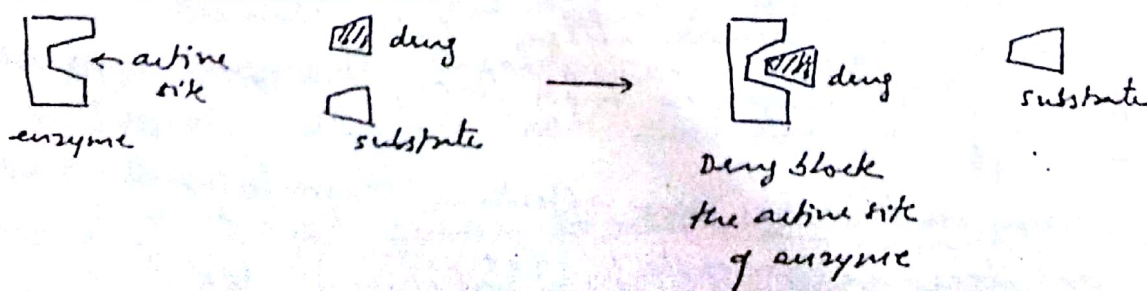
- (i) Enzymes provide active site to hold the substrate molecules for chemical reaction. The interaction between enzyme active site and substrate may be ionic bonding, H-bonding, van der Waals or dipole-dipole.
- (ii) The enzyme also provide functional groups that will attack the substrate and carry out chemical reaction.

Drug-enzyme interaction

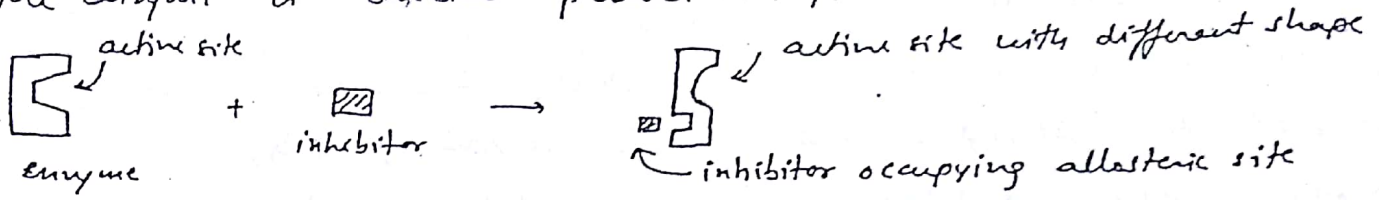
Drugs can block the active site of the enzyme and prevent the binding of substrate and can inhibit the catalytic activity of the enzyme. Such drugs are called enzyme inhibitors.

Drugs inhibit the attachment of substrate on active sites of enzymes in two different ways:

- (i) Drug compete with the natural substrate for their attachment on the active sites of enzyme. Such drugs are called competitive inhibitors.



- (ii) Drugs do not bind to the active site of enzyme but bind to a different site of enzyme which is called allosteric site. The binding of inhibitor at allosteric site changes the shape of the active site in such a way that substrate can't fit into the active site. If the bond between enzyme and inhibitor is a strong covalent bond and can't be broken easily, then the enzyme is blocked permanently.



Receptors are proteins that are crucial to body's communication process. Receptors are embedded in cell membranes. There are large number of different receptors in the body that interact with different chemical messengers.

Drugs that bind to the receptor site and inhibit its natural function are called antagonists and are useful when blocking of message is required. Drugs that bind to the receptor and switch it on are called agonists. These are useful when there is lack of natural chemical messengers.

Chemicals in Food

1. Artificial sweeteners : Natural sweeteners add to caloric intake and therefore many people prefer to use artificial sweeteners which have low caloric intake.

(i) Saccharin : 500 times as sweet as cane sugar.

- entirely inert and harmless when taken.
- great value to diabetic persons

(ii) Aspartame : 100 times as sweet as cane sugar

- It is a protein based artificial sweetener.
- use is limited to cold food items such as soft drinks, ice-creams.
- unstable at cooking temperatures.

- ii) Alitame : high potency sweetener, more stable than aspartame.
 - with alitame, the control of sweetness of food is difficult.
- v) Sucralose : trichloro derivative of sucrose
 - stable at cooking temperature, does not provide calories.

Food Preservatives prevents spoilage of food due to microbial growth.

They helps in increasing shelf life of food.

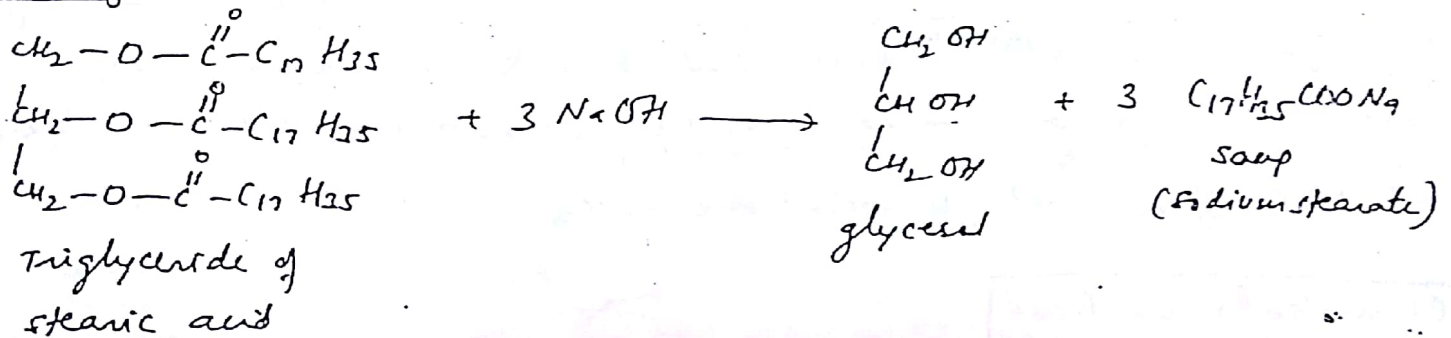
Examples: Table salt, sugar, sodium benzoate.

Anti-oxidants are the chemicals which, when added prevents the food from getting spoiled by the action of oxygen.

Example: BHA (Butylated hydroxy anisole)

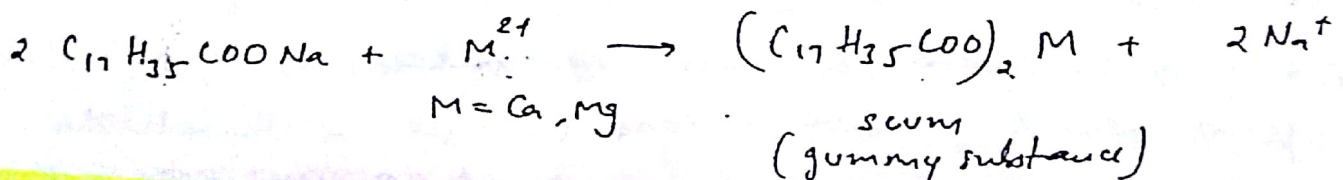
BHT (Butylated hydroxy toluene)

Soaps : Soaps are the sodium or potassium salts of long-chain carboxylic acids (called fatty acids). Soaps are formed by the alkaline hydrolysis of vegetable oil or fats. The reaction is called saponification.



Soap is precipitated from the solution by adding sodium chloride.

Soaps do not work in hard water. Hard water contains Mg^{2+} and Ca^{2+} ions. These ions react with soap to form insoluble white substance called scum.



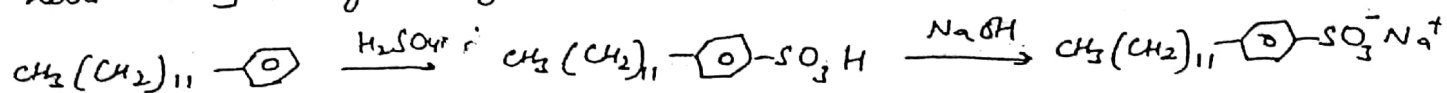
Soaps are biodegradable and do not cause water pollution.

Synthetic detergents are cleaning agents, can be used in both soft and hard water as they give foam even in hard water.

1. What type of drug the paracetamol is? What medicinal effect does it have on the human body?
2. Define the following and give one example of each:
(i) Anti-oxidants (ii) Antihistamines (iii) Anti-fertility drugs
3. Describe the following types of substances with suitable examples.
(i) Antiseptics (ii) Tranquilizers (iii) Antacids.
4. What are the following substances? Give one example of each of them:
(i) Cationic detergents (ii) Enzymes (iii) Sweetening agents
5. Explain the following with examples:
(i) Nonionic detergents (ii) Antipyretics (iii) Disinfectants
6. How do antiseptics differ from disinfectants? Give one example of each type.
7. Explain the following types of substances with one suitable example:
(i) Anionic detergents (ii) Food preservatives (iii) Analgesics.
8. What are biodegradable and non-biodegradable detergents? Give one example of each class.
9. (i) What are the main constituents of dettol?
(ii) What is tincture of iodine? What is its use?
10. (i) Why is use of aspartame limited to cold foods and drinks?
(ii) Name the sweetening agent used in the preparation of sweets for a diabetic patient.
11. Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem? Name two such drugs.
12. (i) What problem arises in using alitame as artificial sweetener?
(ii) Why do soaps not work in hard water?
13. What is meant by the term 'broad spectrum antibiotics'? Explain.
14. Why are cimetidine and ranitidine better antacids than sodium hydrogen carbonate or magnesium or aluminium hydroxide?
15. Which forces are involved in holding the drugs to the active sites of enzymes?

Synthetic detergents are classified into three categories on the basis of whether the larger part is -ve or +ve or neutral.

- (1) Anionic detergents contain larger part as anion. There are sodium salts of sulphonated long chain alcohols or hydrocarbons. Alkyl benzene sulphonates are anionic detergents obtained by neutralising alkyl benzene sulphonic acid with alkali.



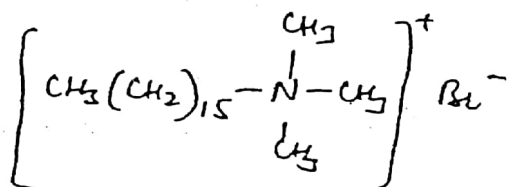
These linear alkyl benzene sulphonates are biodegradable. These are used for household work, toothpaste.

- (2) Cationic detergents are the quaternary ammonium salts with larger part present as cation. Example is cetyltrimethyl ammonium bromide. This is used in hair conditioners.

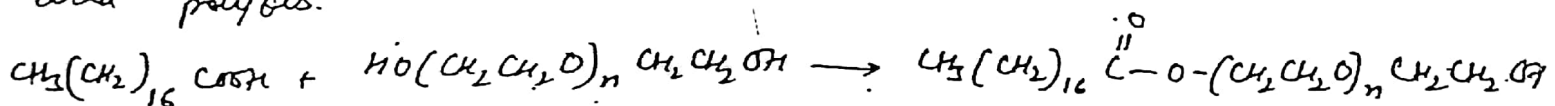
Due to highly branched cationic part,

these detergents are non-biodegradable.

These detergents have germicidal properties.



- (3) Non-ionic detergents do not contain any ion in their constitution. These detergents are basically the esters derived from fatty acid and polyols.



Non-ionic detergents are used as light dishwashing detergents.

These detergents help in removing grease and oil.