

### CHEMICALS IN USE

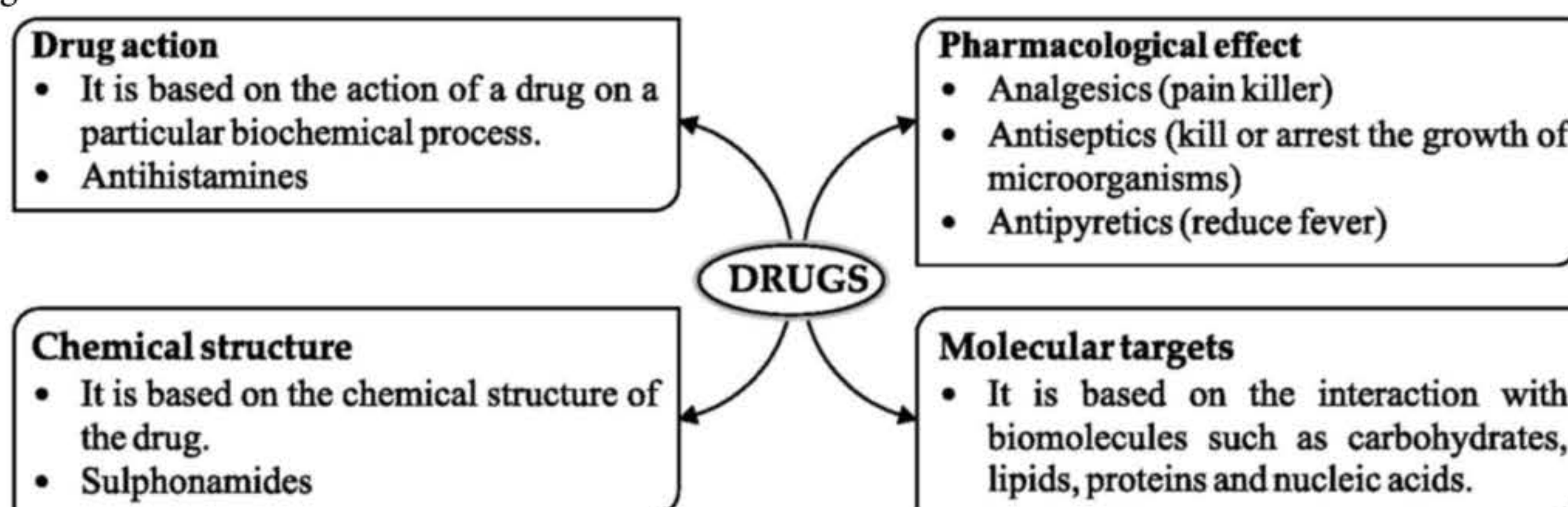
- In various areas, chemicals are used as
  - medicines for the treatment of diseases.
  - food materials
  - cleansing agents like soaps, detergents, household bleaches, tooth pastes, etc.
  - synthetic fibres made up of chemicals only.

### Chemicals in Medicines

- Drugs are the chemicals of low molecular masses (~ 100-500 u) which interact with macromolecular targets and produce a therapeutic and useful biological response. These chemicals are called medicines.
- Use of chemicals for therapeutic effect is called chemotherapy.

### Classification of Drugs

- Drugs are classified on the basis of



### Drug Target Interaction

- **Enzymes as drug target :** Drugs inhibit any of the two activities of the enzymes, they can block the binding site of the enzyme and prevent the binding of substrate or they can inhibit the catalytic activity of enzyme.
- **Receptors as drug target :** Proteins which transmit communication to the different parts of the body are called receptors. Receptor proteins are embedded in the cell membrane and receptor changes its shape to accommodate a chemical messenger which brings about transfer of message into the cell.
- **Drug interact with receptors in two ways :**
  - Drugs bind to their receptor sites and inhibit its natural function (antagonists). These are useful when blocking of message is required.
  - Some drugs mimic the natural messenger by switching on the receptor (agonists). These are useful when there is lack of natural chemical messenger.

### Therapeutic Action of Different Classes of Drugs

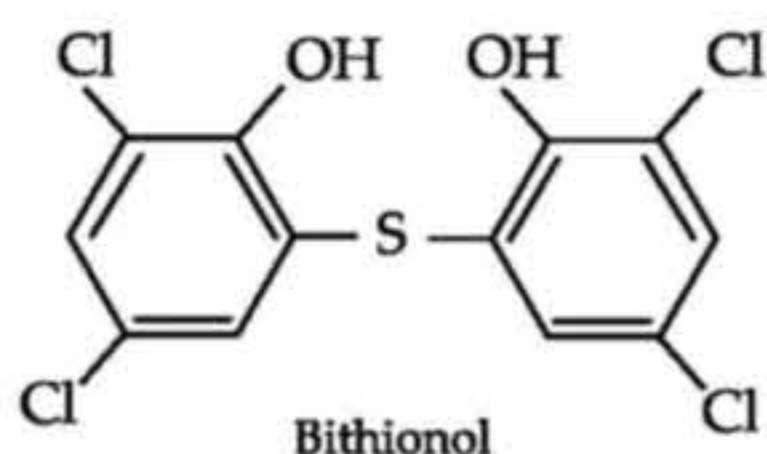
- **Analgesics :** These are chemical substances which reduce pain. They are classified as :
  - (i) Non-narcotic analgesics and (ii) Narcotic drugs
  - (i) **Non-narcotic analgesics :** Aspirin and paracetamol belong to this class of drugs. They are effective in relieving skeletal pain such as that due to arthritis. They have many other effects such as reducing fever (antipyretic) and preventing platelets coagulation. Aspirin finds use in prevention of heart attacks because of its anti blood clotting action.
  - (ii) **Narcotic analgesics :** Morphine and many of its homologues, when administered in medicinal doses, relieve pain and produce sleep. In poisonous doses, they cause convulsions and ultimately death. These are mainly used for the relief of post operative pain, cardiac pains and pains of terminal cancer.
- **Tranquilizers :** These are chemical substances used for the treatment of stress, mild and severe mental



diseases. They are neurologically active drugs and are also called psychotherapeutic drugs, *e.g.*, veronal, amytal, seconal, equanil, chlordiazepoxide, etc.

Veronal, amytal, and seconal are called barbiturates. Barbiturates are hypnotics, *i.e.*, sleep producing agents.

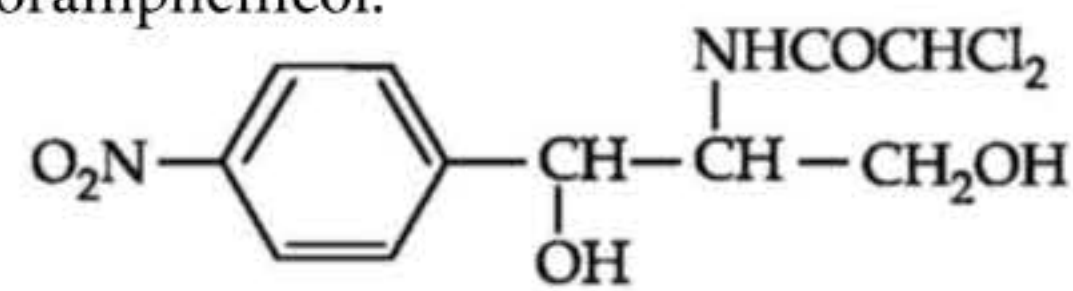
- **Antiseptics** : These are chemicals which either kill or prevent the growth of microorganisms and are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces.
  - Dettol is a commonly used antiseptic and it is a mixture of chloroxylenol and terpineol.
  - Bithionol is added to soaps to reduce odours produced by bacterial decomposition of organic matter on the skin.



- Tincture of iodine, *i.e.*, 2-3% solution of iodine in alcohol-water mixture is applied on wounds.
- **Disinfectants** : These are also used to kill microorganisms, but they are applied to inanimate objects.
  - Some substances can act both as antiseptic as well as disinfectant by varying the concentration.
  - 0.2% phenol is an antiseptic, whereas its 1% solution is disinfectant.
  - 0.2 - 0.4 ppm chlorine in aqueous solution acts as disinfectant.
- **Antimicrobials** : These are chemical substances used to cure infections due to microorganisms, *e.g.*, sulphadiazine, sulphapyridine, etc.
- **Antifertility drugs** : Chemical substances used to prevent conception or fertilization are called antifertility drugs. These are essentially a mixture of estrogen and progesterone derivatives which are more potent than the natural hormones, *e.g.*, mifepristone, ormeloxifene, etc.
- **Antibiotics** : These drugs are chemical substances produced wholly or partly by chemical synthesis which in low concentration inhibit the growth or destroy microorganisms by intervening in their metabolic processes.
  - The antibiotics may be either bactericidal (kill the organisms in the body) *e.g.*, penicillin, ofloxacin, etc., or bacteriostatic (inhibit the

growth of organisms), *e.g.*, erythromycin, chloramphenicol, etc.

- Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be broad spectrum antibiotics, *e.g.*, tetracycline, chloromycetin and chloramphenicol.



Chloramphenicol

- Those effective mainly against Gram-positive or Gram-negative bacteria are narrow spectrum antibiotics, *e.g.*, penicillin-G.
- **Antacids** : These are chemicals which neutralize excess acid in the gastric juices and give relief from acid indigestion, acidity, heart burns and gastric ulcers, *e.g.*, magnesium hydroxide, calcium carbonate, etc.
- **Antihistamines** : These drugs diminish or abolish the main actions of histamine released in the body and hence prevent allergic reactions, they are also called anti-allergic drugs, *e.g.*, diphenylhydramine (benadryl), pheniramine maleate (avil), etc.

### Chemicals in Food

- **Preservatives** : These are the chemical substances which are added to the food materials to prevent their spoilage and to retain their nutritive value for long periods. These preservatives prevent the rancidity of food and inhibit the growth or kill the microorganisms.
- The preservation of food by adding sufficient amount of salt to it is called salting. Salt prevents the water from being available for microbial growth.
- The microbial growth in food materials can also be prevented by adding certain chemical substances. The most common preservative used is sodium benzoate ( $C_6H_5COONa$ ). It is metabolised by conversion to hippuric acid,  $C_6H_5CONHCH_2COOH$  which is ultimately excreted through urine.

## Quotable Quote

“Once you replace negative thoughts with positive ones, you’ll start having positive results.”

**WILLIE NELSON**



- Certain food preservatives such as BHA and BHT are used for edible oils, also act as antioxidants.
- **Artificial sweetening agents** : These are chemical compounds which give sweetening effect to the food and enhance its odour and flavour.

Artificial sweetener	Sweetness value in comparison to cane sugar
Aspartame	180
Sucralose	650
Alitame	2000

- **Antioxidants** : These are the chemical substances which prevent oxidation and subsequent spoilage of the food. These act as sacrificial materials, *i.e.*, they are more reactive towards oxygen than the materials they are protecting. They also reduce the rate of involvement of free radicals in the ageing process.

### PEEP INTO PREVIOUS YEARS

7. Among the following, the narrow spectrum antibiotic is
- (a) chloramphenicol      (b) penicillin G  
(c) ampicillin              (d) amoxicillin.

(NEET 2019)

8. The correct match between item-I and item-II is

Item-I	Item-II
A. Allosteric	P. Molecule binding effect to the active site of enzyme
B. Competitive	Q. Molecule crucial for inhibitor communication in the body
C. Receptor	R. Molecule binding to a site other than the active site of enzyme
D. Poison	S. Molecule binding to the enzyme covalently

- (a) A → P, B → R, C → Q, D → S  
(b) A → R, B → P, C → Q, D → S  
(c) A → P, B → R, C → S, D → Q  
(d) A → R, B → P, C → S, D → Q

(JEE Main 2019)

9. The reason for “drug induced poisoning” is
- (a) binding reversibly at the active site of the enzyme  
(b) bringing conformational changes in the binding site of enzyme  
(c) binding at the allosteric sites of the enzyme  
(d) binding irreversibly to the active site of the enzyme.

(JEE Main Online 2017)

10. Which of the following is an analgesic?

- (a) Streptomycin      (b) Chloromycetin  
(c) Novalgin            (d) Penicillin

(NEET-I 2016)

### Cleansing Agents

- Soaps are sodium or potassium salts of long chain fatty acids, *e.g.*, stearic, oleic and palmitic acids. Soaps containing sodium salts are prepared by heating glyceryl ester of fatty acid with aqueous NaOH solution and the reaction is known as saponification.
- Only Na/K soaps are soluble in water and are used for cleaning purposes. Generally, potassium soaps are soft to the skin than sodium soaps.
- **Types of soaps**
  - Toilet soaps are prepared by using better grades of fats and oils and care is taken to remove excess alkali. Colour and perfumes are added to make them more attractive.
  - Soaps that float in water are made by beating tiny air bubbles before their hardening. Transparent soaps are made by dissolving the soap in ethanol and then evaporating the excess solvent.
  - In medicated soaps, substances of medicinal value are added. In some soaps, deodorants are added. Shaving soaps contain glycerol to prevent rapid drying. A gum called, rosin is added while making them. It forms sodium rosinate which lathers well. Laundry soaps contain fillers like sodium rosinate, sodium silicate, borax and sodium carbonate.
  - Soap chips are made by running a thin sheet of melted soap onto a cool cylinder and scraping off the soaps in small broken pieces. Soap granules are dried miniature soap bubbles. Soap powders and scouring soaps contain some soap, a scouring agent (abrasive) such as powdered pumice or finely divided sand, and builders like sodium carbonate and trisodium phosphate.



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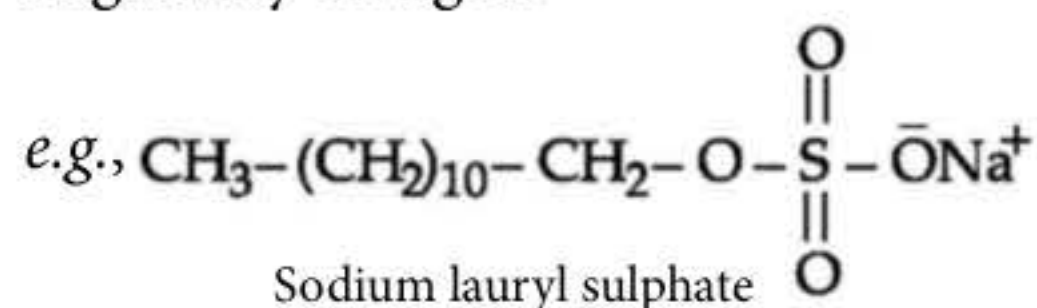
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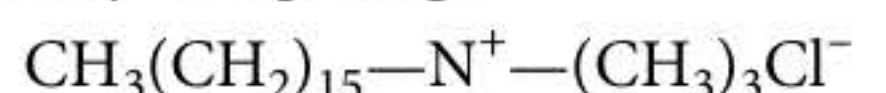
- **Detergents** : These are the materials which are used for cleaning purposes. They are also called soapless soaps.

- **Anionic detergents** : Their polar head is negatively charged.



Such detergents are used to wash clothes.

- **Cationic detergents** : Their polar head is positively charged e.g.,

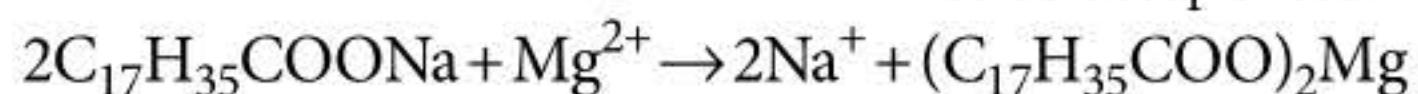
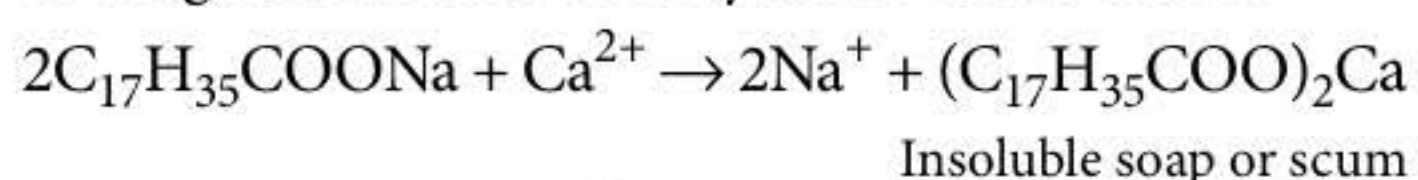


Trimethylhexadecylammonium chloride

These are used as fabric softener and hair conditioner.

- **Non-ionic detergents** : Their polar head is neutral e.g., Polyethyleneglycol stearate,  $\text{CH}_3(\text{CH}_2)_{16}\text{COO}(\text{CH}_2\text{CH}_2\text{O})_n\text{CH}_2\text{CH}_2\text{OH}$   
Such detergents are used in dish washers.

- **Action of soap in hard water** : Hard water contains  $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$  ions which react with sodium or potassium salts of fatty acids (soap) to form calcium or magnesium salts of fatty acids called scum.



- **Advantages of synthetic detergents over soaps** :

- They can be used in hard water, in acidic medium while soaps get precipitated.
- They are more soluble in water and thus form lather more easily.
- They are stronger cleansing agents than soaps as they decrease the surface tension to greater extent.

### PEEP INTO PREVIOUS YEARS

11. The liquified gas that is used in dry cleaning along with a suitable detergent is

- (a) water gas (b) petroleum gas  
(c)  $\text{NO}_2$  (d)  $\text{CO}_2$ .

(Odisha NEET 2019)

12. Which of the following is an anionic detergent?

- (a) Sodium stearate  
(b) Sodium lauryl sulphate  
(c) Cetyltrimethylammonium bromide  
(d) Glyceryl oleate

(JEE Main 2016)

### POINTS FOR EXTRA SCORING

- Ibuprofen is a chiral drug. Only its (S)-isomer is effective but (R)-isomer has no anti-inflammatory action. However, the (R)-isomer is slowly converted into the (S)-isomer in the body but the (S)-isomer alone acts much more quickly than the racemate.

#### Uses of sulpha drugs :

Sulphapyridine : used to cure pneumonia.

Sulphadiazine : used to cure pneumonia, throat infection, meningitis, etc.

Sulphaguanidine : used to cure bacillary dysentery.

Sulphathiazole : useful against staphylococcal infections and bubonic plague.

Succinyl sulphathiazole : useful in intestinal infections such as bacillary dysentery and cholera.

Sulpha acetamide : used to cure urinary tract infections.

- Ranitidine and cimetidine are used in the treatment of peptic ulcers.

- Pentaprazole and omeprazole are the new drugs used to inhibit gastric secretion.

- In addition to sugar and salt the substances such as vinegar, oils, spices and citric acid are also used to preserve jam, pickles, ketchups and squashes, etc.

- Highly branched sodium alkylbenzene-sulphonates are non-biodegradable.

### Answer Key For Peep Into Previous Years

- |    |     |    |     |    |     |     |        |     |     |     |     |
|----|-----|----|-----|----|-----|-----|--------|-----|-----|-----|-----|
| 1. | (d) | 2. | (d) | 3. | (c) | 4.  | (a, c) | 5.  | (b) | 6.  | (d) |
| 7. | (b) | 8. | (b) | 9. | (c) | 10. | (c)    | 11. | (d) | 12. | (b) |