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An Initiative by अमर उजाला

CHEMISTRY IN EVERYDAY LIFE

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DRUGS

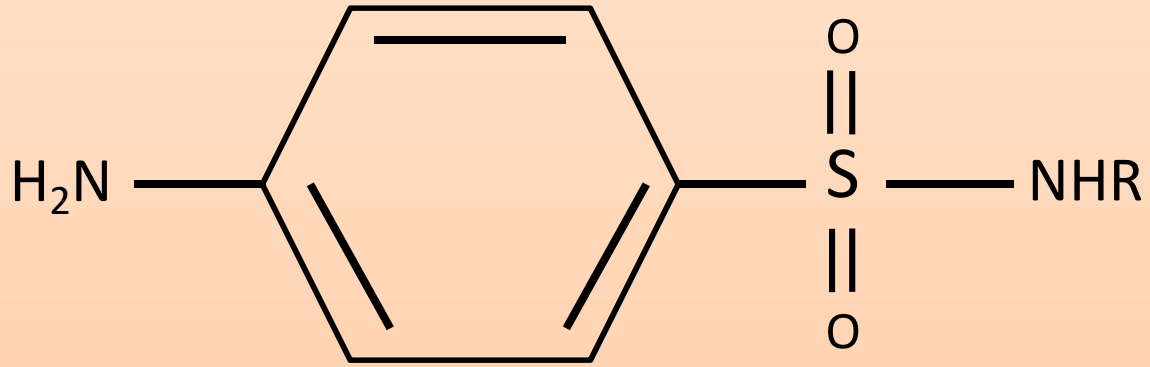
- Chemical substances of natural or synthetic origin which are used for curing diseases and reducing suffering from pain are called *DRUGS* or *MEDICINES.*
  - A *Drug* is a chemical substance which cures the disease but is habit forming, causes addiction and has serious side effects.
  - A *Medicine* is a chemical substance which cures the disease, is safe to use, has negligible toxicity and does not cause any addiction.

CLASSIFICATION OF DRUGS

- **DRUGS can be classified in a number of ways : -**
  - **On the basis of Pharmacological Effect.**
    - It is useful for doctors as it provides a whole range of drugs available for the treatment of a particular type of problem.
      - **Ex :-** Analgesics have pain killing effect.
  - **On the basis of Drug action.**
    - It is based on the action of a drug on a particular biochemical process.
      - **Ex :-** All antihistamines inhibit the action of the compound.

On the basis of Chemical Structures.

- Drugs classified in the way share common structural features and often have similar pharmacological activity.
  - Ex :- Sulphonamides have common structuralfeature.



On the basis of Molecular Targets.

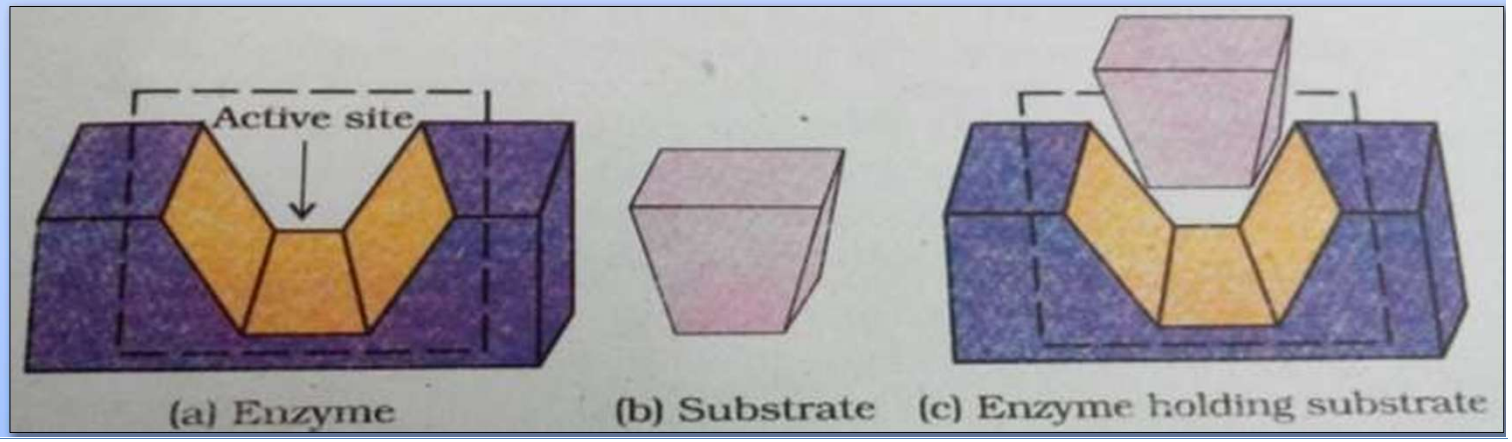
- Drugs usually interact with biomolecules such as Lipids, Proteins. These are called target molecules or Drug Targets.
- Drugs possessing some common structural features may have the same mechanism of action on targets.

DRUG – TARGET INTERACTION

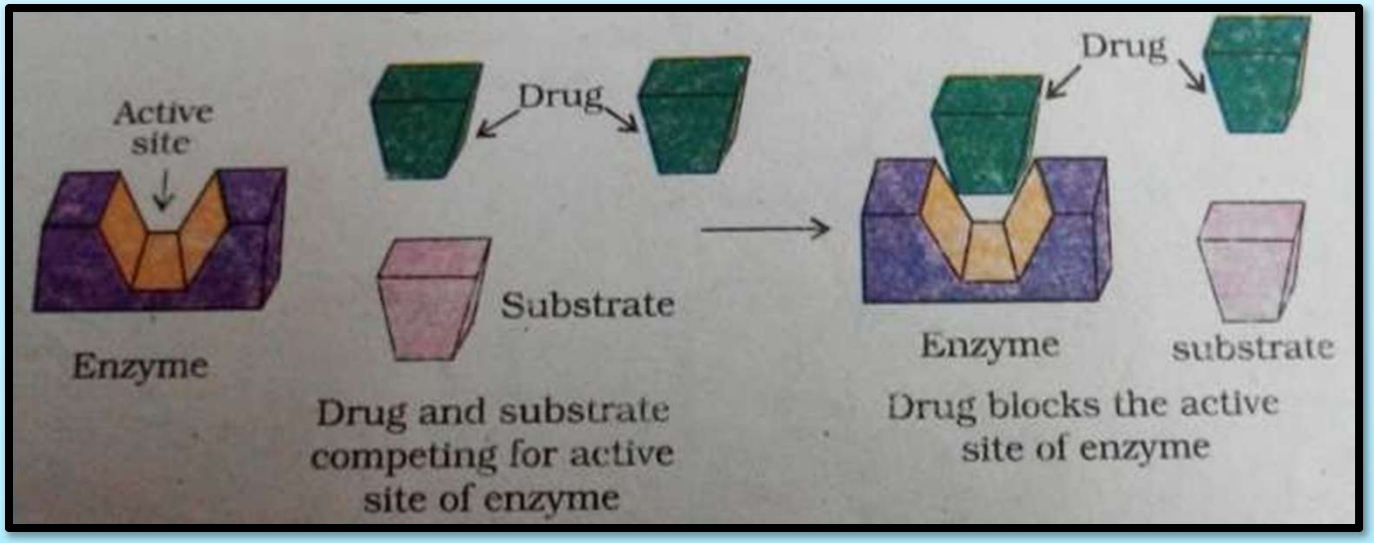
- **Macromolecules of biological origin performs various functions in the body.**
  - Proteins which perform the role of biological catalysts in the body are called ***ENZYMES.***
  - Those proteins which are crucial to communication system in the body are called ***RECEPTORS.***
  - Those proteins which carry polar molecules across the membranes are called ***CARRIER PROTIENS.***

ENZYMES AS DRUG TARGET

- **Catalytic action of Enzymes**
  - **The first function** of an enzyme is to hold the substrate for a chemical reaction. Active sites of enzymes hold the substrate molecule in a suitable position, so that it can be attacked by the reagent effectively.
  - **The second function** of an enzyme is to provide functional groups that will attack the substrate and carry out the chemical reaction.



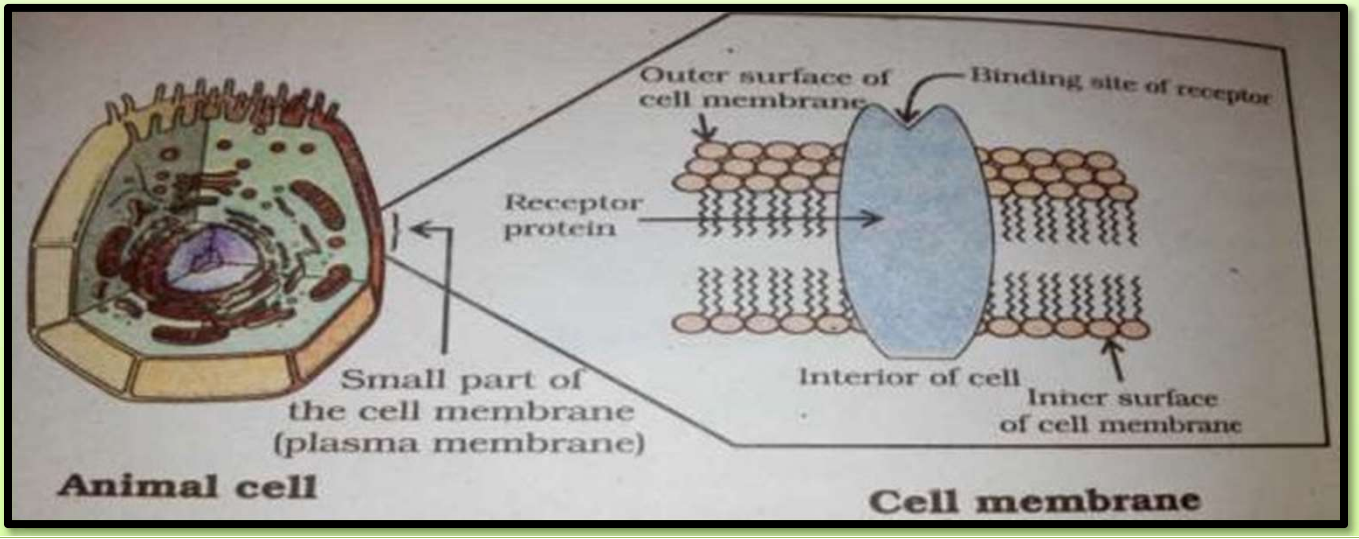
- **Drug – Enzyme Interaction**
  - Drug inhibit the attachment of substrate on active site of Enzymes in two different ways : -
    - Drugs compete with the natural substrate for their attachment in the active sites of enzymes. Such drugs are ***competitive inhibitors.***



    - Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called ***Allosteric Site.*** This binding of inhibitor at allosteric site changes the shape of the active site in such a way that substrate cannot recognize it.

RECEPTORS AS DRUG TARGETS

- **RECEPTORS** are proteins which are crucial to the communication system in the body. Majority of these are embedded in cell membranes in such a way that their small part possessing the active site projects out of the surface of the membrane and opens in the outside region of the cell membrane.



- In the body, message between two neurons and that between neurons to muscles is communicated through certain chemicals. These chemicals, known as ***CHEMICAL MESSENGERS*** are received at the binding sites of receptor proteins. To accommodate a messenger, shape of the receptor site changes. This brings about the transfer of message into the cell. Thus, chemical messenger gives message to the cell without entering the cell.

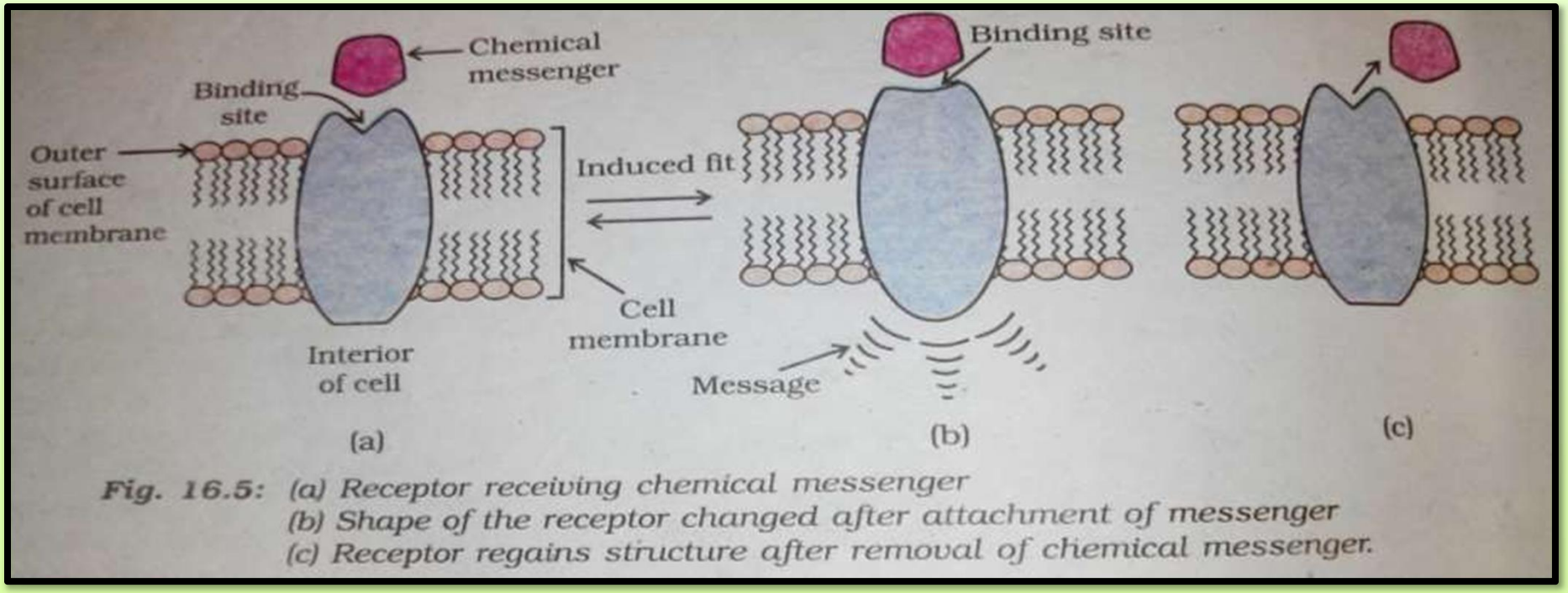
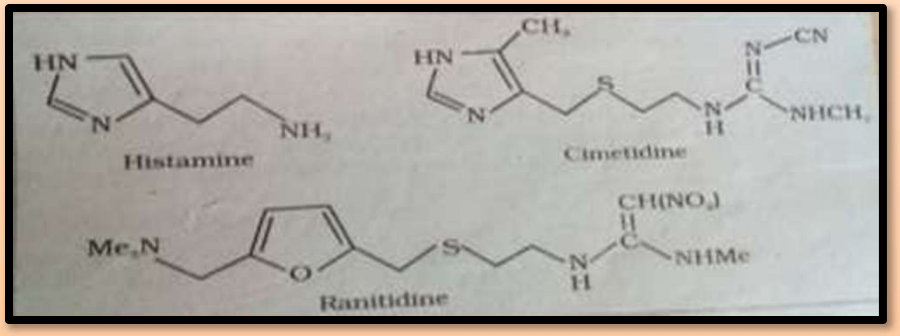


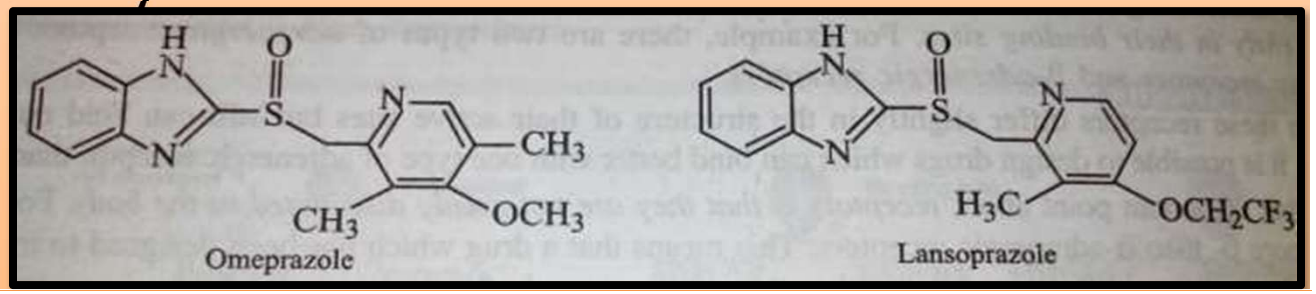
Fig. 16.5: (a) Receptor receiving chemical messenger
(b) Shape of the receptor changed after attachment of messenger
(c) Receptor regains structure after removal of chemical messenger.

TYPES OF DRUGS

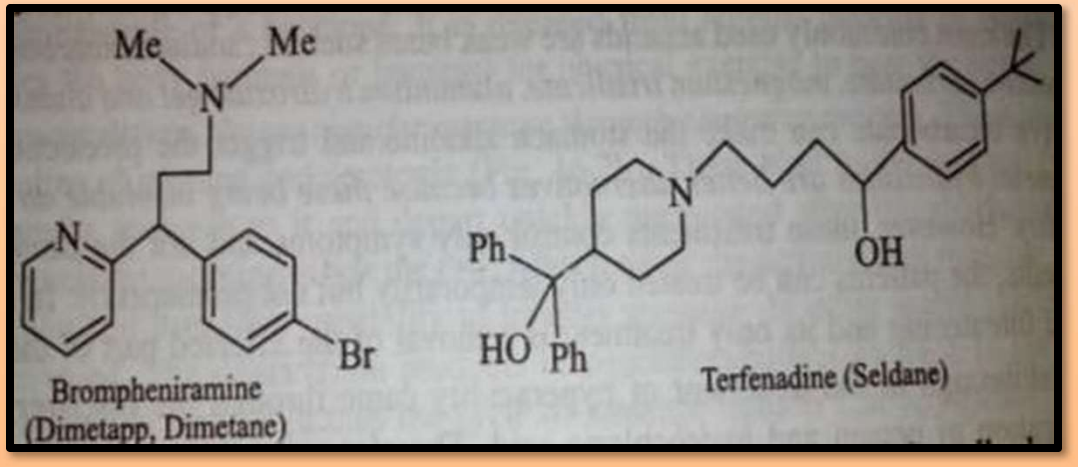
- **ANTACIDS**
  - Those substances which neutralizes the excess acid and raise the pH to an appropriate level in stomach are called **ANTACIDS.**
  - Most commonly used antacids are :-
    - Sodium Bicarbonate, Magnesium Hydroxide etc.
  - **Some Important Drugs :-**
    - Cimetidine
    - Ranitidine



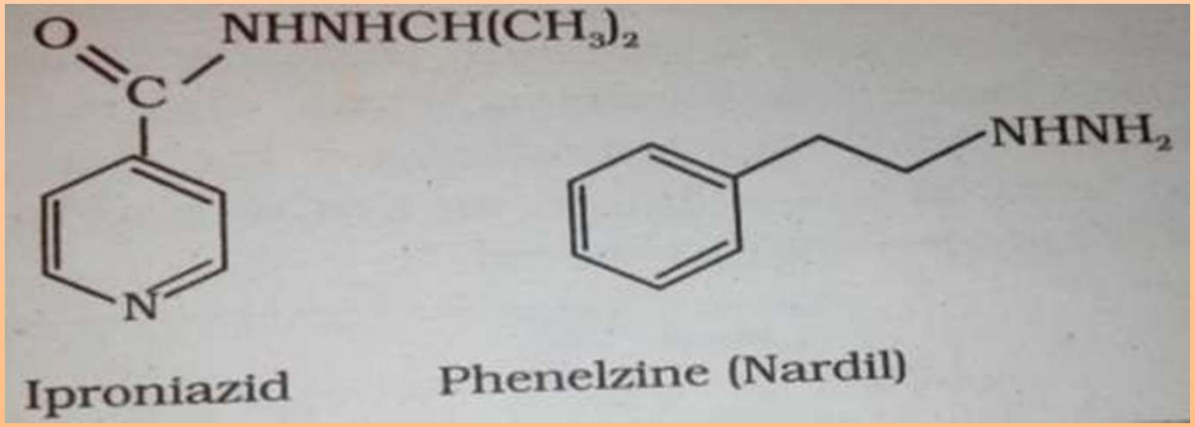
  - Drugs used recently :-
    - Omeprazole
    - Lansoprazole



- **ANTIHISTAMINES**
  - The hypersensitivity of some persons to some drugs, dust, pollen grains, cat fur etc. is called **ALLERGY** and is due to release of a substance called **HISTAMINE** in the body.
  - The drugs which interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effects are called **ANTIHISTAMINES** or **ANTI – ALLERGIC DRUGS.**
  - The antihistamines which are widely used are : -
    - Bromopheniramine
      - (Dimetapp, Dimetane)
    - Terfenadine
      - (Seldane)



- # NEUROLOGICALLY ACTIVE DRUGS
  - ## TRANQUILIZERS
    - Drugs which are used for the treatment of stress, fatigue, mild and severe mental disease are called **TRANQUILIZERS.**
    - They relive anxiety, stress, irritability by inducing a sense of well being.
    - If a person suffers from **DEPRESSION**, In such cases, **ANTIDEPRASSANT DRUGS** are used.
    - The Important antidepressant drugs are :-
      - Iproniazid
      - Phenelzine



– ANALGESICS

- Analgesic Neurologically active drugs which reduce or abolish pain without causing impairment of consciousness, mental confusion, incoordination or paralysis or some other disturbance or disorder of the nervous system are called **ANALGESICS.**

- These can be classified in two categories : -

– NON – NARCOTIC (NON - ADDICTIVE) ANALGESICS

» Non-narcotic analgesics are medications used to control pain and inflammation.

» Non-Narcotic are used to treat acute or persistent pain that is mild to moderate. They also may be used in combination with other medications or therapies to treat moderate to severe pain.

» **EX : -** Aspirin, Motrin or Advil (Ibuprofen), and Aleve or Naprosyn (Naproxen Sodium).

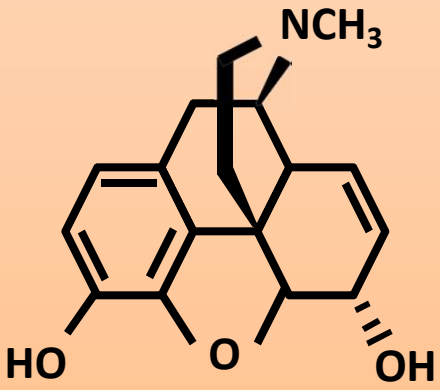
NARCOTIC ANALGESICS

» Narcotic are medications that mimic the activity of endorphins, substances produced by the body to control pain.

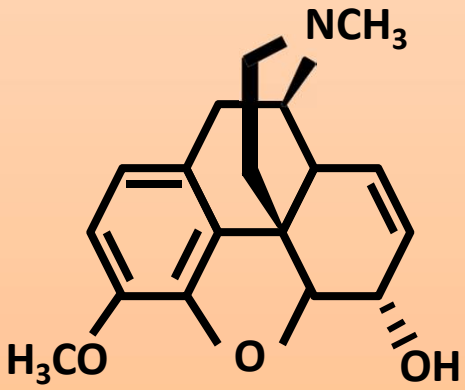
» Narcotic are used to treat acute pain related to surgery and other medical procedures, as well as for persistent (chronic) and breakthrough pain that is moderate to severe.

» Morphine and many of its homologous, when administrated in medical doses, relieve pain and produce sleep. In poisonous doses, these produce stupor, coma and ultimately death.

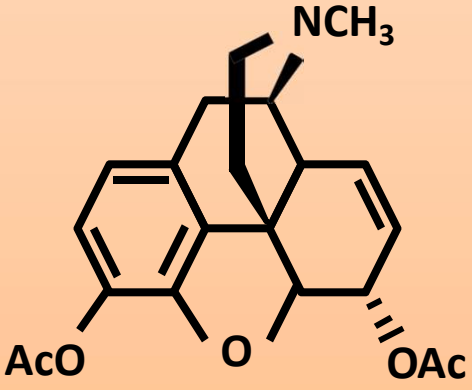
» Ex :- Roxanol (morphine), Codeine, Dolophine (methadone), Heroin etc.



MORPHINE

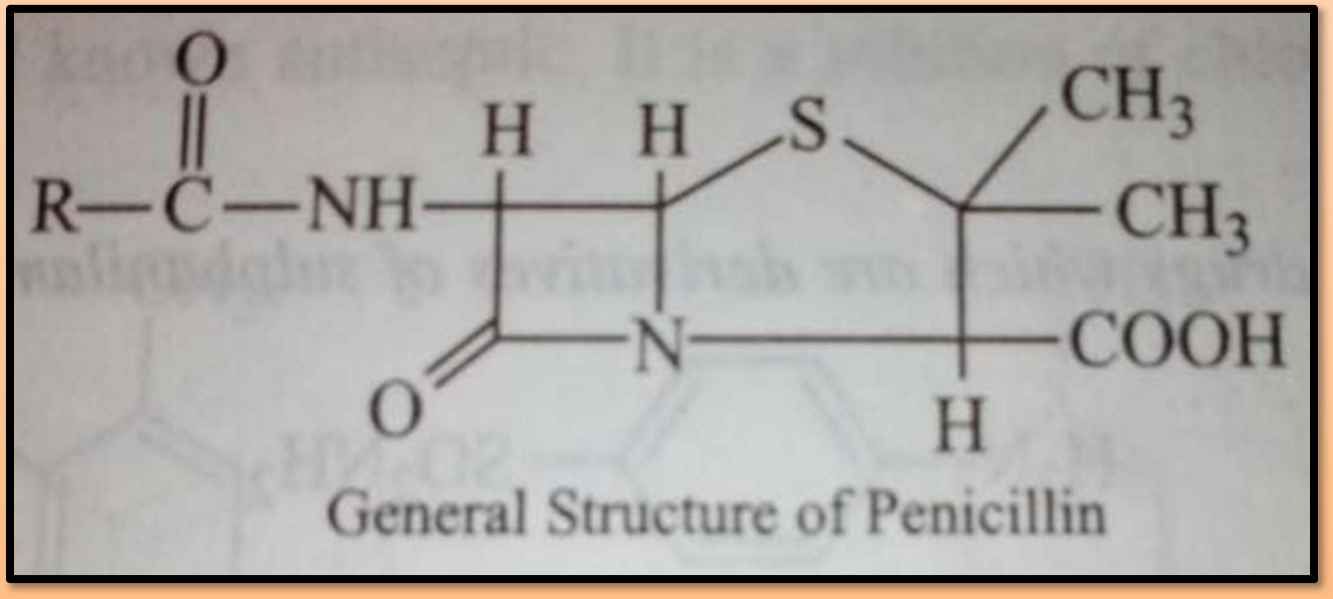


CODIENE



HEROIN

- **ANTIMICROBIALS**
  - Drugs which are used to cure diseases caused by microbes or microorganisms such as bacteria, viruses, fungi etc. are called **ANTIMICROBIALS**.
  - **ANTIBIOTICS**
    - These are chemical substances , which in low concentration, either kill or inhibit the growth of microorganisms by intervening in their metabolic processes.
    - The first antibiotic was Penicillin. Its structure is :-



General Structure of Penicillin

- Types of Antibiotics :
  - **BACTERICIDAL**
    - » Penicillin
    - » Aminoglycosides (Streptomycin)
    - » Ofloxacin

  BACTERIOSTATIC

  Erythromycin

  Tetracycline

  Chloramphenicol

- The full range of microorganisms attacked by an antibiotic is called its ***SPECTRUM.***
- Antibiotics which kill or inhibit a wide range of Gram – Positive and Gram – Negative bacteria are called ***BROAD SPECTRUM ANTIBIOTICS.***
  - ***EX : -*** *Chloramphenicol, Ofloxacin etc.*
- The antibiotics which are effective mainly against Gram – Positive or Gram – Negative bacteria are ***NARROW SPECTRUM ANTIBIOTICS.***
  - ***EX : -*** Penicillin G etc.
- The antibiotics which are effective against a single organism or disease, they are called ***LIMITED SPECTRUM ANTIBIOTICS.***

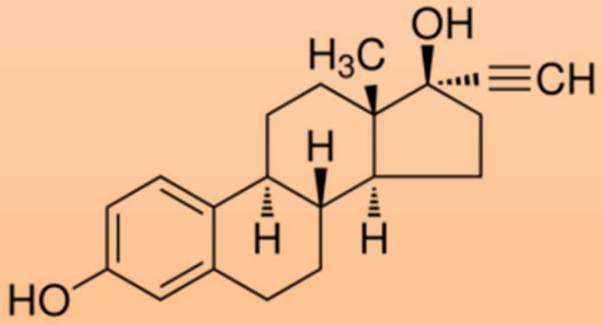
ANTISEPTICS AND DISINFECTANTS

- **ANTISEPTICS** are the chemical substances which prevent the growth of microorganisms and may even kill them. They are safe to be applied to living tissues.
  - Commonly used antiseptics, Dettol is a mixture of chloroxylenol and terpineol.
  - **EX :-** Furacine, Soframicine etc.

- **DISINFECTANTS** are chemical substances which kill microorganisms but are not safe to be applied to living tissues.
  - These are applied to inanimate objects such as Floors, Drainage system etc.
  - **EX :-** 1% solution of Phenol work as a Disinfectant, 0.2 – 0.4 ppm in Aq. Solution of Chlorine and low concentration of Sulphur Dioxide are Disinfectants.

- **ANTIFERTILITY DRUGS**
  - Chemical substances which are used to check pregnancy in women are called **ANTIFERTILITY DRUGS** or **BIRTH CONTROL PILLS** or **ORAL CONTRACEPTIVES.**
  - These control the female menstrual cycle and ovulation.
  - Some of the commonly used pills contain a mixture of Norethindrone (progesterone derivative) and Novestrol or Ethinlestradiol (An Estrogen).
  - All such drugs are expected to have side effects and hence should be used under proper medical advice.

norethindrone



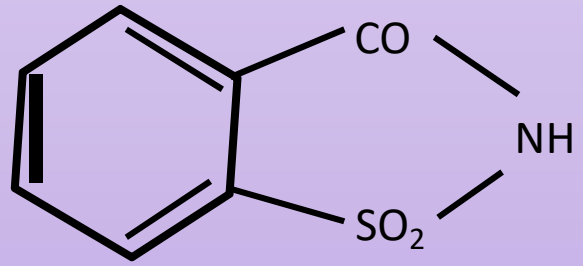
Ethinlestradiol

CHEMICALS IN FOOD

- All those chemicals which are added to food to improve its keeping qualities, appearance, taste, odour and nutritive value are called **FOOD ADDITIVES.**
- Some important food additives are :-
  - Food Colours
  - Flavors and sweetener
  - Fat emulsifiers and stabilizing agents
  - Flavor improvers – ant staling agent and bleaches Antioxidants
  - Preservatives
  - Nutritional supplement such as Minerals, Vitamins, and Amino acid

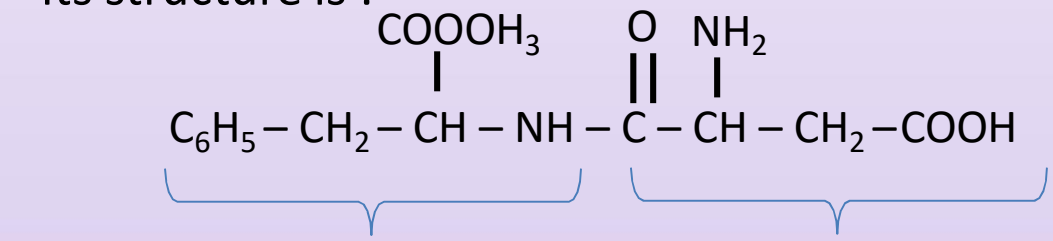
ARTIFICIAL SWEETENING AGENTS

- Sucrose and Fructose are the most widely used natural sweetener. But they add to our calorie intake and promote tooth decay.
- To avoid these problems, many people take artificial sweeteners.
- Some important artificial sweetener are :-
  - **Saccharin(o - sulphobenzimide)**
    - It is the first most popular artificial sweetener. It has been used as a sweetening agent.
    - Since it is insoluble in water, therefore it is sold in the market as its soluble sodium or calcium salt.
    - It is about 550 times sweeter than sugar.



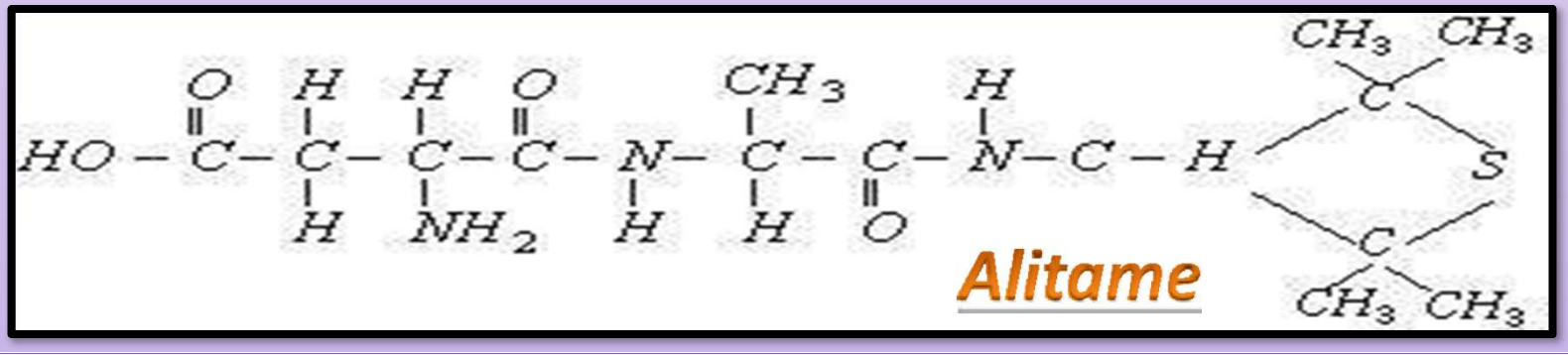
Saccharin (Insoluble in water)

- **Aspartame**
  - It is one of the most successful and widely used artificial sweetener.
  - It is roughly 100 times as sweet as Sucrose.
  - It decomposes at baking or cooking temp. , and hence can be used only in cold foods and soft drinks.
  - Its structure is : -



Aspartame

- **Alitame**
  - It is similar to Aspartame. However more stable than Aspartame.
  - It is about 2000 times as sweet as Sucrose.



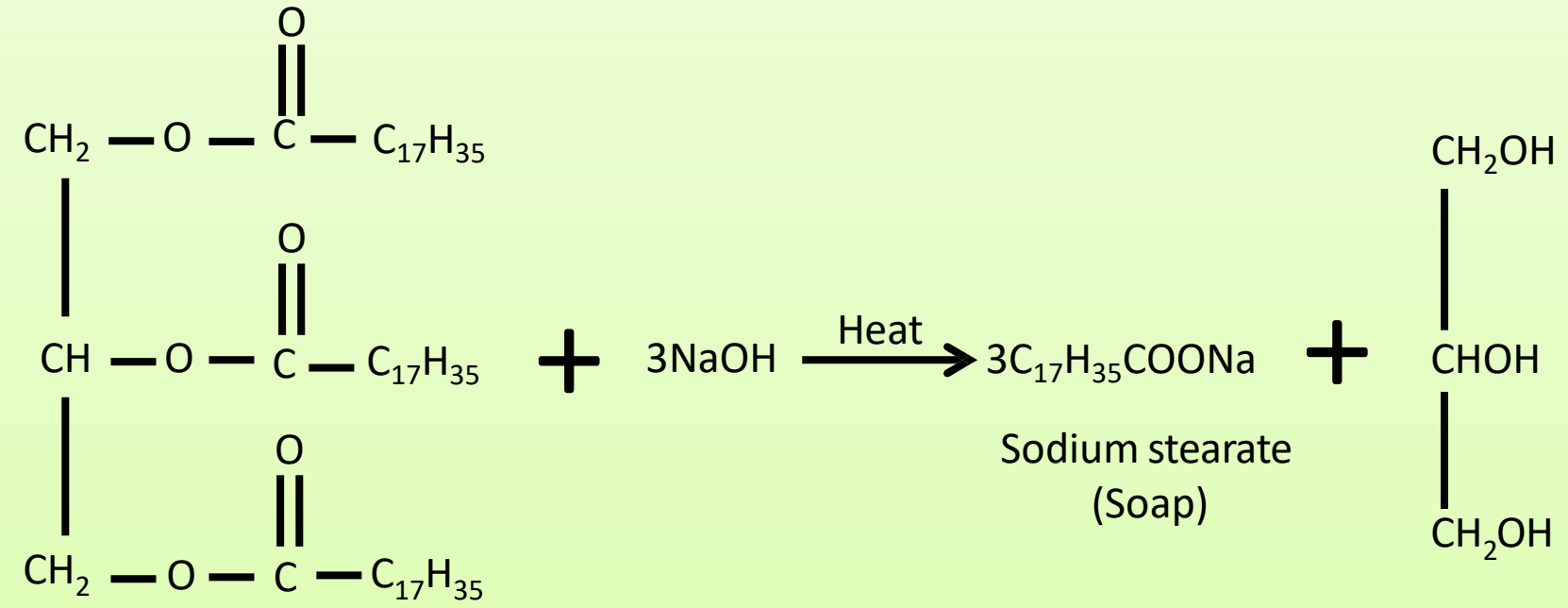
- **FOOD PRESERVATIVES**
  - Chemical substances which are used to protect food against bacteria, yeasts and moulds are called **FOOD PRESERVATIVES.**
  - Some common preservatives are : -
    - ***Sodium Benzenoate –*** It is used in soft drinks and acidic foods.
    - ***Sodium Metabisulphite –*** It is used as a preservative for products such as Jams, Squashes, Pickles etc.
    - ***Sorbic acids and its salts –*** It is used for controlling the growth of yeasts and moulds in products like Cheese, Baked food etc.
    - ***Epoxides –*** These are highly effective in preservation of low moisture food. It is mainly used for preservation of Spices, Nuts and Dried fruits.
    - ***P –Hydroxybenzoate esters –*** They have no perceptible effect on flavor and are effective in inhibiting the growth of moulds and yeasts but are less effective on bacteria.

CLEANSING AGENTS

- **Cleaning agents** can be defined as natural or synthetic substances that are used to assist the cleaning process. Cleaning is primarily the removal of dirt and dust.
- Chemical substances which concentrate at the surface of the solution or interfaces, form surface films, reduce surface tension of the solution and help in moving dirt and dust by emulsifying grease are called Surface active agents or Surfactant. This active agent contains two groups one oil loving lipophilic and the other water loving – hydrophilic.
- These are of two types : -
  - Soaps
  - Synthetic Detergents

SOAPS

- Soaps are Sodium or Potassium salts of higher fatty acids such as lauric acid, palmitic acid, stearic acid, oleic acid.
- Soaps are formed by heating fat or oil with Aq. Sodium Hydroxide solution. This reaction is called ***Saponification.***



Fat
(Tristearin or Glyceryl ester of Stearic acid)

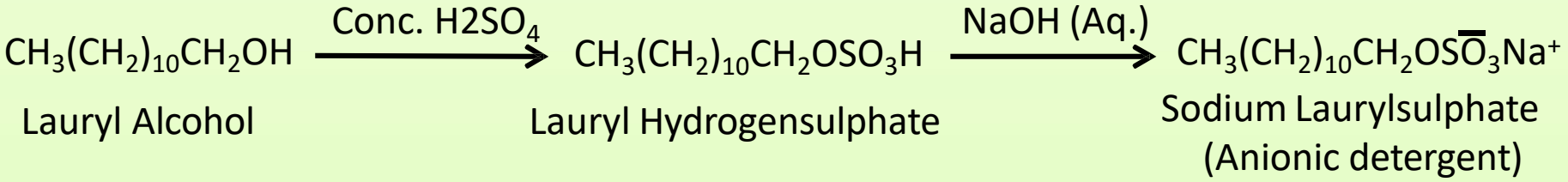
Types of Soaps

- ***Toilet Soaps* –** Prepared by using better grades of fats and oils and care is taken to remove the excess alkali.
- **Floating Soaps –** Prepared by beating tiny air bubbles into the product before their hardening.
- **Transparent Soaps –** Prepared by dissolving the soap in ethanol and then evaporating the excess solvent.
- **Medicated Soaps –** Prepared by adding some antiseptics like Dettol, Savlon etc.
- **Shaving Soaps –** Contains glycerol to prevent rapid drying. While preparing, a gum called rosin is added to them. It forms Sodium Rosinate which lathers well.
- **Laundry Soaps –** Contains fillers like Sodium Rosinate, Sodium Silicate, Borax and Sodium Carbonate.
- **Soap Chips –** made by running a thin sheet of melted soap on to a cool cylinder and scrapping off in small broken pieces.
- **Soap Granules –** Dried miniature soap bubbles.
- **Soap Powder and Scouring Soaps –** Contain some soap, a scouring agent such as powdered pumice or finely divided sand.

- **SYNTHETIC DETERGENTS**
  - Soap less soap are cleansing agents which have all the properties of soaps, but which actually do not contain any soap. Since these are synthetic substances, therefore they are called Synthetic Detergents or Detergents.
  - **Detergents** may be defined as Ammonia, Sulphate salts of long chain hydrocarbons containing 12 – 18 carbon atoms.
  - Types of Detergents
    - Detergents are of three types : -
      - Anionic Detergents
      - Cationic Detergents
      - Non – ionic detergents

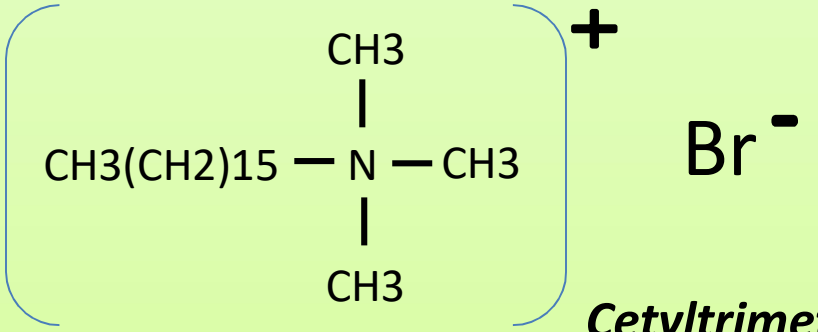
– *Anionic Detergents*

- These are so called because a large part of their molecules are anions and it is the anionic part of the molecule which is involved in their cleansing action.
- These are sodium salts of sulphonated long chain alcohols or hydrocarbons.



– *Cationic Detergents*

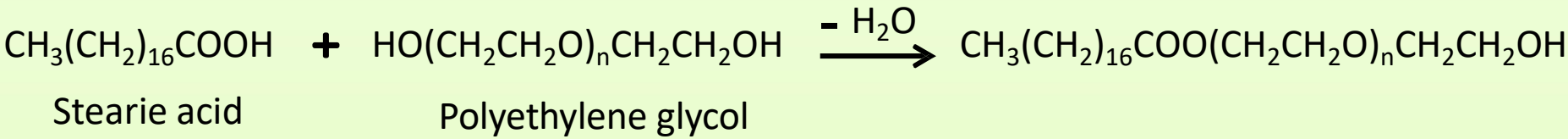
- These are quaternary Ammonium salts of amines with acetates, chlorides or bromides as anions.



Cetyltrimethyl Ammonium Bromide

– *Non – Ionic Detergents*

- These do not contain any ion in their constitution.
- One such detergent is formed when stearic acid reacts with polyethylene glycol.



- Liquid Dishwashing detergents are non – ionic type.
- Mechanism of cleansing action of this type of detergents is the same as that of soaps.