

CHEMISTRY IN EVERYDAY LIFE

Drugs are low molecular mass (100-500 u) substances which interact with targets in the body and produce a biological response.

Medicines The chemicals which causes therapeutic and useful biological response .

Chemotherapy - chemicals for therapeutic effect

Classification of Drugs

Pharmacological effect - drugs used for a particuler type of problems. analgesics & antiseptics

Drug action - action of a drug on a particular biochemical process antihistamines.

Chemical Structure - common structural features and often have similar pharmacological activity.

Molecular targets - interact with biomolecules such as carbohydrates, lipids, proteins and nucleic acids also called target molecules or drug targets.

Drug-Target Interaction

Enzymes - biological catalysts proteins.

Receptors - protiens act as communication system

- (a) Catalytic action of enzymes :
 - (i) hold the substrate on active site for a chemica reaction by enzyme in a suitable position through a variety of interactions.
 - (ii) to provide functional groups that will attack the substrate and carry out chemical reaction

(b) Drug-enzyme interaction :

Drugs(enzyme inhibitors) inhibit any activities of enzymes by blocking the binding site of the enzyme and prevent the binding of substrate through competitive inhibitors & deform the active site by binding to a different site of enzyme which is called allosteric site.

Antagonists - Drugs that bind to the receptor site and inhibit its natural function

Agonists - drugs that mimic the natural messenger by switching on the receptor.

Antacids:

Chemical substances which neutralize excess acid in the gastric juices and give relief from acid indigestion, acidity, heart burns and gastric ulcers Examples: Eno, gelusil, digene etc. excess of acid in stomach causing pains normally treated with sodium hydrogen carbonate or amixture of aluminium and magnesium hydroxide.on excess use of it will results production of even more acid. These treatments control only symptoms

Antihistamines :

Antihistamines: Chemical substances which diminish or abolish the effects of histamine released in body and hence prevent allergic reactions Examples: Brompheniramine (Dimetapp) and terfenadine (Seldane)

For treatment of hyperacidity is cimetidine(Tegment) which prevent the interaction of histamine with receptor present in stomach wall.Zantac is also used.Also usefull in other allergy like conjuctivities & rhinities.allergic response to pollen.Synthetic drugs, brompheniramine (Dimetapp) and terfenadine (Seldane), act as antihistamines. They interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect.above mentioned antihistamines not affect the secretion of acid in stomach because antiallergic and antacid drugs work on different receptors.

Tranquilizers :

Affect the message transfer mechanism from nerve to receptor. used for the treatment of stress, and mild or even severe mental diseases Low level of noradrenaline cause depression in such case antidepressant drugs help by inhibiting the enzymes which catalyse the degradation of noradrenaline

Example: Iproniazid and phenelzine chlordiazepoxide and meprobamate, are relatively mild tranquilizers suitable for relieving tension. Equanil is used in controlling depression and hypertension.

Barbiturates Derivatives of barbituric acid are hypnotic veronal, amytal, Some other substances used as tranquilizers are valium and serotonin.

Analgesics drugs which reduce or abolish pain

(a) Non-narcotic (non-addictive) :

Analgesics:Aspirin inhibits the synthesis of prostaglandins which stimulate inflammation in the tissue and cause pain.helpful in arthritis also used as antipyretic(Reduces fever) & in anti blood clotting action like prevention of heart attacks.

(b) Narcotic analgesics :

Relieve pain and produce sleep. produces stupor, coma, convulsions and ultimately death

Antimicrobials tends to destroy/prevent development or inhibit the pathogenic action of microbes such as bacteria, fungi, virus.

(a) Antibiotics :

A substance produced wholly or partly by chemical synthesis, which in low concentrations inhibits the growth or destroys microorganisms by intervening in their metabolic processes.

Arsphenamine (salvarsan) is first effective medicine for syphilis.Prontosil is another antibactrial used for syphilis due to similier structure Antibiotics have either cidal (killing) effect or a static (inhibitory) effect on

Bactericidal	Bacteriostatic	
Drugs that kills organisms in body.	Drugs that inhibits growth of organisms	
Examples: Penicillin, Aminoglycosides, Ofloxacin	Examples: Erytromycin, Tetracycline, Chloramphenicol	

Classification of antibiotics on basis of its spectrum of action:

Broad Spectrum Antibiotics : Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria.effective mainly against Gram-positive or Gram-negative bacteria are

Narrow Spectrum Antibiotics effective against a single organism or disease, they are referred to as limited spectrum antibiotics.

Wide Range Spectrum effective against several different types of harm ful micro organisms. *Chloramphenicol* can be given orally in case of typhoid, dysentery, acute fever, certain form of urinary infections, meningitis and pneumonia. In India, penicillin is manufactured at the Hindustan Antibiotics in Pimpri.

Antiseptics are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces. Examples are furacine, soframicine

Dettol is a mixture of chloroxylenol and terpineol.

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Bithionolthe compound is added to soaps to impart antiseptic properties. Iodine is a powerful antiseptic. Its 2-3 per cent solution in alcohol water mixture is known as **tincture of iodine**. It is applied on wounds. Iodoform is also used as an antiseptic for wounds.

Boric acid in dilute aqueous solution is weak antiseptic for eyes.

Disinfectants are applied to inanimate objects such as floors, drainage system, instruments, etc.

0.2 per cent solution of phenol is an antiseptic while its one percent solution is disinfectant.

Antifertility Drugs Birth control pills essentially contain a mixture of synthetic estrogen and progesterone derivatives. Both of these compounds are hormones. It is known that progesterone suppresses ovulation. Synthetic progesterone derivatives are more potent than progesterone. exapmple Norethindrone

Artificial Sweetening Agents used to control intake of calories. Ortho-sulphobenzimide (saccharin) is the first popular artificial sweetening agent.

Aspartame : 100 times as sweet as cane sugar- methyl ester of dipeptide formed from aspartic acid and phenylalanine. Only used in cold foods(unstable at cooking temperature).

Alitame : avoided due to the control of sweetness of food is difficult while using it.

Sucrolose: (trichloro derivative of sucrose) - stable at cooking temperature.

Food preservatives - table salt, sugar, vegetable oils and sodium benzoate, C₆H₅COONa

Soaps: Only sodium and potassium (soft to the skin) soaps are soluble in water and are used for cleaning purposes.

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hydroxide

water Soaps that float in water - made by beating tiny air bubbles before their hardening the soaps in small broken pieces. soaps do not work in hard water due to formation of insoluble

(or Glycerine)

stearate

Transparent soaps made by dissolving the soap in ethanol and evaporating the excess solvent.

Medicated soaps medicinal value are added

of stearic acid (Fat)

Shaving soaps contain glycerol to prevent rapid

Drying Laundry soaps contain fillers like sodium rosinate, sodium silicate, borax and sodium

Advantages of using soaps: Soap is a good cleansing agent and is 100% biodegradable i.e., micro- organisms present in sewage water can completely oxidize soap. Therefore, soaps do not cause any pollution problems

Disadvantages of using soaps: the Soaps cannot be used in hard water because hard water contains metal ions like Ca2+ and Mg2+ which react with soap to form white precipitate of calcium and magnesium salts

Anionic Detergents

$CH_3(CH_2)_{10}CH_2OH \xrightarrow{H_2SO_4} \rightarrow$	CH ₃ (CH ₂) ₁₀ CH ₂ OSO ₃ H	NaOH (aq.)	$CH_3(CH_2)_{10}CH_2OSO_3Na$
Lauryl alcohol	Lauryl hydrogensulphate		Sodium laurylsulphate (Anionic detergent)



Dodecylbenzene

Dodecylbenzenesulphonic acid

Sodium dodecylbenzenesulphonate

used for household work & in toothpastes.

Cationic Detergents: Cetyltrimethyl ammonium bromide CH3(CH2)15 N(CH3)3 + Cl- used in hair conditioners.germicidal properties and are expensive, therefore, these are of limited use.

Non-ionic Detergents

$$\begin{bmatrix} CH_3 \\ I \\ CH_3(CH_2)_{15} - N - CH_3 \\ I \\ CH_3 \end{bmatrix}^+ Br^-$$

Cetyltrimethyl ammonium bromide

Unbranched chains can be biodegraded more easily and hence pollution is prevented.

ADDITIONAL QUESTIONS

- **Q1.** Sleeping pills are recommended by doctors to the patients suffering from sleeplessness but it is not advisable to take its doses without consultation with the doctor. Why ?
- **Ans.** Most of the drugs taken in doses higher than recommended may cause harmful effect and act as poison. Therefore, a doctor should always be consulted before taking medicine.
- Q2. With reference to which classification has the statement, "ranitidine is anantacid" been given?
- **Ans.** This statement refers to the classification according to pharmacological effect of the drug because any drug which will be used to counteract the effect of excess acid in the stomach will be called antacid.
- **Q3.** Following type of non-ionic detergents are present in liquid detergents, emulsifying agents and wetting agents. Label the hydrophilic and hydrophobic parts in the molecule. Identify the functional group(s) present in the molecule.



Q4. Which forces are involved in holding the drugs to the active site of enzymes?

Ans. Either of the following forces can be involved in holding drugs to the active sites of enzymes.

- (i) Ionic bonding
- (ii) Hydrogen bonding
- (iii) Dipole dipole interaction
- (iv) van der Waals force

- **Q5.** Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem ?Name two drugs.
- **Ans.** Anti-depressant drugs are needed to counteract the effect of depression. These drugs inhibit enzymes catalysing the degradation of the neurotransmitter, noradrenaline. As a result, the important neurotransmitter is slowly metabolised and then it can activate its receptor for longer periods of time.

Two anti-depressant drugs are:

- (i) Iproniazid &
- (ii) Phenelzine
- **Q6.** Why are cimetidine and ranitidine better antacids than sodium hydrogen carbonate or magnesium or aluminium
- **Ans.** Antacids such as sodium hydrogen carbonate, magnesium hydroxide, and aluminium hydroxide work by neutralising the excess hydrochloric acid present in the stomach. However, the root cause for the release of excess acid remains untreated. Cimetidine and rantidine are better antacids These drugs prevent the interaction of histamine with the receptors present in the stomach walls. Consequently, there is a decrease in the amount of acid released by the stomach. hydroxide?
- Q7. What are biodegradable and non-biodegradable detergents? Give one example of each.
- Ans. Detergents that can be degraded by bacteria are called biodegradable detergents. Such detergents have straight hydrocarbon chains. For example: sodium lauryl sulphate

Detergents that cannot be degraded by bacteria are called non-biodegradable detergents. Such detergents have highlybranched hydrocarbon chains. For example: sodium -4- (1, 3, 5, 7- tetra methyl octyl) benzene sulphonate

Q8. What is the chemical name of antiseptic chloroxylenol ?

Ans. 4-Chloro-3, 5-dimethyl phenol.

- **Q9.** Which alkaloid is used to control hypertension ?
- Ans. Reserpine.
- Q10. Which alkaloid is used to treat malaria?

Ans. Quinine.

Q11. What is the use of the following compound :

OCOCH₃ COOH

Ans. Analgesic.2-Acetoxy benzoic acid (**aspirin**) It inhibits the synthesis of prostaglandins which stimulates inflammation of the tissue and cause pain.

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- Q12. Name the antibacterial present in toothpaste.
- Ans. Triclosan.
- Q13. Identify the drug :



Ans. Penicillin G.

Q14. Which antibiotic contains NO2 group attached to aromatic nucleus in its structure ?

Ans. Chloramphenicol.

Q15. Give an example of a drug that is antipyretic as well as analgesic.

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Ans. Paracetamol.
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- **Q16.** Out of morphine, N-Acetyl-para-aminophenol, Diazepam and tetrahydrocatenol, which can be used as analgesic without causing addiction ?
- Ans. N-Acetyl-para-aminophenol.
- Q17. Pick the odd one amongst the following on the basis of their medicinal properties mentioning the reason.
 - (i) Luminal, seconal, phenacetin, equanil
 - (ii) Chloroxylenol, phenol, chlorampherical, bithional
- **Ans.** (i) Phenacetin is an antipyretic while all the rest are tranquilisers.
 - (ii) Chlorampherical is an antibiotic while all the remaining are antiseptics.
- Q18. What is the purpose of adding antioxidants to food ? Give two examples of antioxidants.
- **Ans.** They are added to prevent oxidation of fats and oils present in food thus preventing food from becoming rancid. Eg. BHA (Butylated hydroxy anisole)
 - BHT (Butylated hydroxy toluene)
- **Q19.** (a) Boric acid is a weak antiseptic than tincture of iodine. Give reason.
 - (b) Tincture of iodine is preferred over iodoform as antiseptic. Why?
 - (c) How can you overcome the problem of premature ageing by specific intake of food items. Name some food items that slows down the ageing process. Explain how they act ?