Chemistry in Everyday Life

C OMMUNITY

H EALTH

E NVIRONMENT

M EDICINE

I NDUSTRY

S CIENCES

T EACHING

R ESEARCH

Y OU!

DRUGS

Chemicals which interact with targets in our body and produce biological response

MEDICINE

When the biological response produced becomes therapeutic, we call those drugs/chemicals as medicine

CHEMOTHERAPY

Any therapeutic action/effect caused by a chemical will be termed as chemotherapy

CLASSIFICATION OF DRUGS

Pharmacological effect	Drug action	Chemical structure	Molecular targets
Treatment of a particular type of problem	Particular biochemical process	Common structure have similar pharmacological activity	Enzymes Lipids Carbohydrates Nucleic acids

Drug target interaction

The action of a drug depends on the interaction between the drug and biomolecule that it targets

Enzyme as drug target

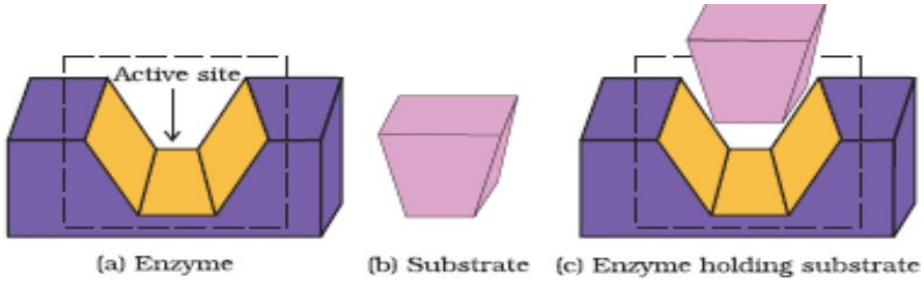
Substrate binds with enzyme the using H-bond, Vander Waals force, Ionic bond , dipole -dipole forces carries out the reaction and forms the desired products.

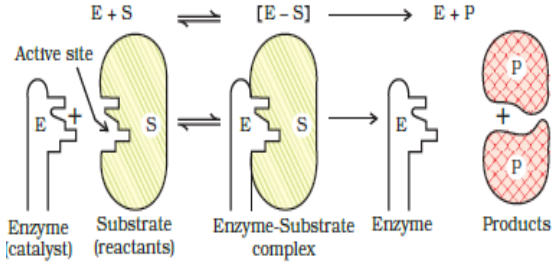
Enzyme in presence of a drug-

A drug may bind to enzymes

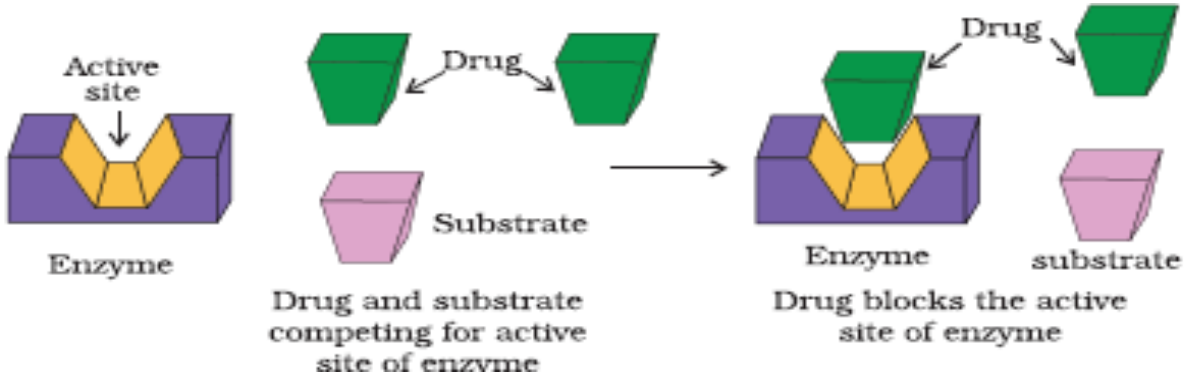
- Active site-inhibit the attachment of the substrate by competitive inhibition
- Allosteric site-attaches to enzyme on a different site-not in the active site-non competitive manner

Normal activity of an enzyme-

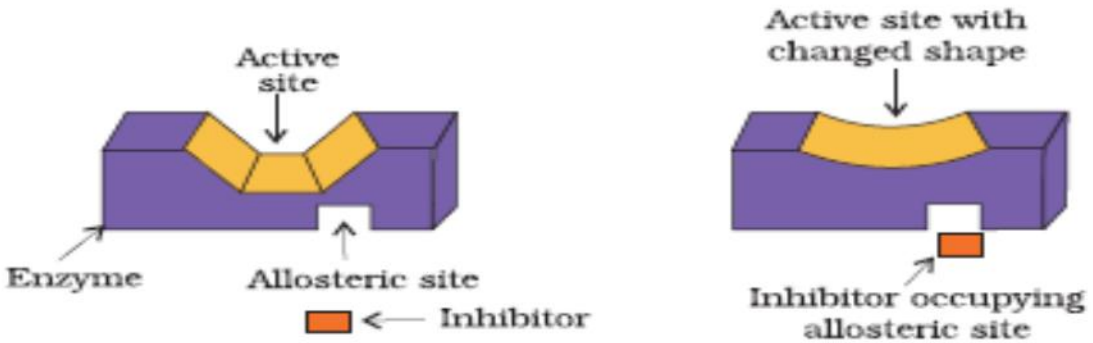




Competitive inhibitor



Non Competitive inhibitor



Receptors as drug target

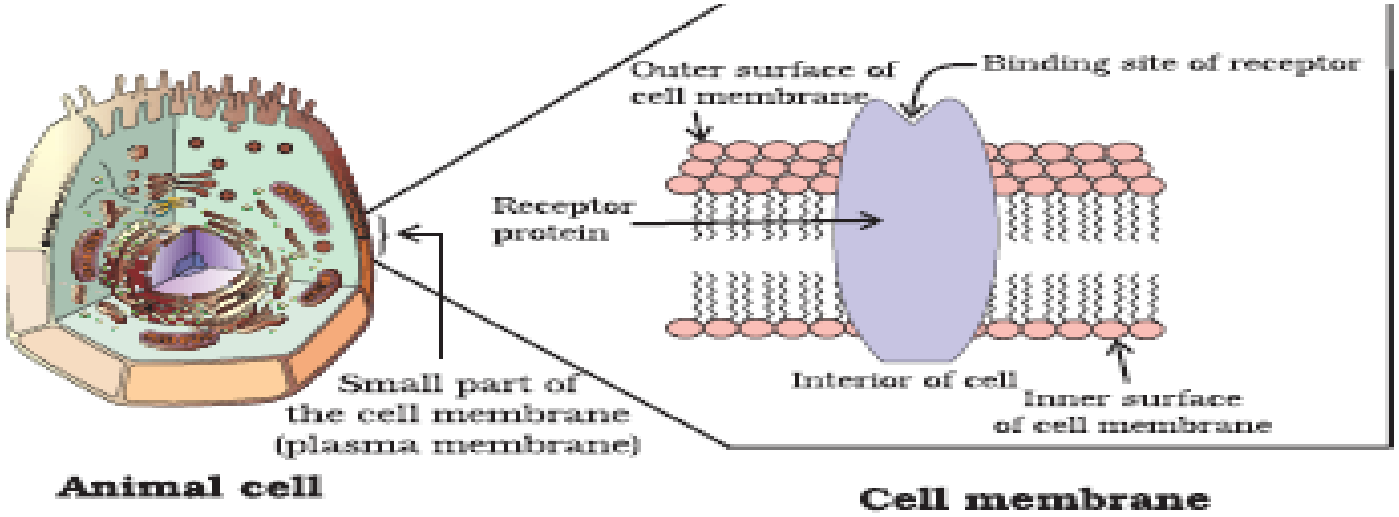
Receptors normal function

Note: Every drug has a different receptor hence they do not interfere with each others function

A drug can act as

- Agonist –drug mimics the action of messenger and attaches the binding site
- Antagonist- drug attaches to the binding site and blocks or opposes the action of messenger

Receptor as drug target



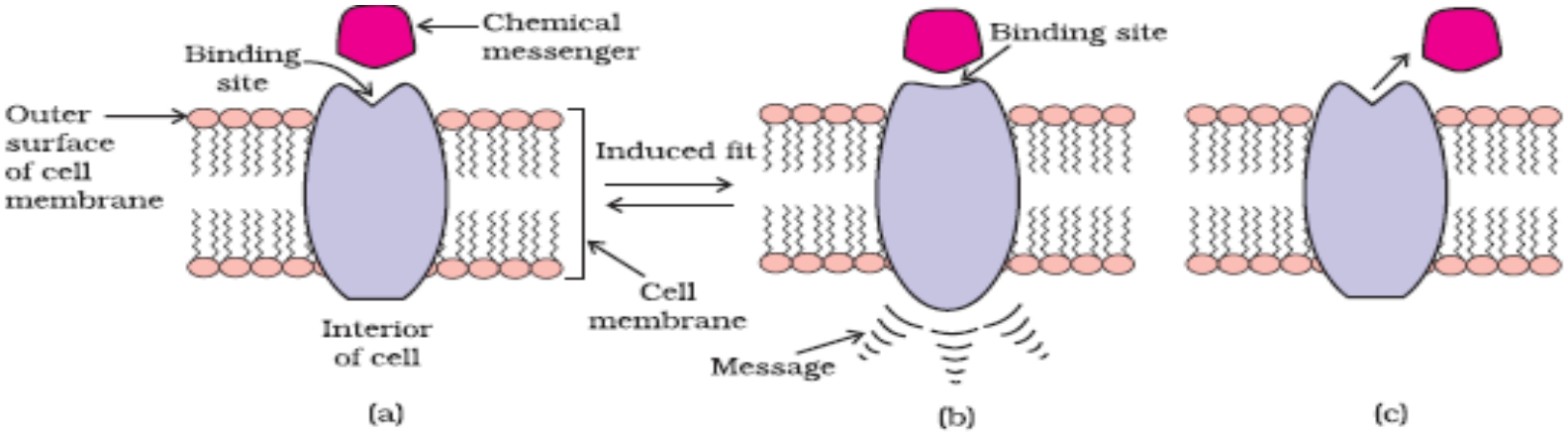


Fig. 16.5: (a) Receptor receiving chemical messenger
(b) Shape of the receptor changed after attachment of messenger
(c) Receptor regains structure after removal of chemical messenger.

DRUG [Therapeutic Action]	FUNCTION	EXAMPLES
ANTACIDS	Neutralizes excess acid secreted by the stomach	Sodium bicarbonate $Mg(OH)_2$ $Al(OH)_3$ Cimetideine Ranitidine
ANTIHISTAMINES Histamine is involved in local immune responses as well as a neurotransmitter and when in excess causes inflammation	Prevents or inhibits or interferes with action of histamines with receptors [anti allergic]	Bromphenaramine Terfenadine
ANTIPYRETIC	Fever relieving	Aspirin Paracetamol
ANTIFERTILITY	Controls ovulation and hence reduces the birth rate that helps in controlling population	Norethindrone Novestrol

NEUROLOGICALLY ACTIVE DRUGS	TRANQUILIZERS ANTIDEPRESSANTS BARBITURATES	Sleep inducing used Treatment of stress anxiety, mental disorders Treats depression - inhibiting the enzyme that degrades the level of noradrenaline Hypnotic and sleep inducing medicines	Chlordiazepoxide Meprobamate Valium Serotonin Iproniazid Phenelzine Equanil Veronal Luminal Seconal
	ANALGESICS	NARCOTIC Relieves pain and induces sleep in medicinal doses but poisonous doses is lethal	Morphine Codeine Heroin
		NON NARCOTIC Relieves pain without causing any addiction	Aspirin Paracetamol

ANTI MICROBIALS [works against pathogens like bacteria, virus, fungi]	ANTIBIOTIC – kills or inhibits growth of microorganisms	• ***Range of activity-*** BROAD SPECTRUM- kills or inhibits wide range of gram +ve and gram –ve bacteria NARROW SPECTRUM-kills or inhibits range of gram +ve or gram –ve bacteria LIMITED SPECTRUM-antibiotics which are specific for certain diseases	Chloramphenicol Penicillin G Dysidazirine
		• ***Mode of action-*** BACTERICIDAL – kills microbes BACTERIOSTATIC-inhibits growth of microbes	Penicillin, Ofloxacin Erythromycin
	ANTISEPTIC	Prevent growth/kill microbes on living tissues	Dettol, Phenol Tincture of iodine Iodoform, bithionol, boric acid
	DISINFECTANTS	Prevent growth/kill microbes on non-living surfaces	Phenol, Chlorine, SO_2

Chemicals in food

Chemicals are added to food for (i) their preservation, (ii) enhancing their appeal, and (iii) adding nutritive value in them. Main categories of food additives are as follows:

(i) Food colours
(ii) Flavours and sweeteners
(iii) Fat emulsifiers and stabilising agents
(iv) Flour improvers - antistaling agents and bleaches
(v) Antioxidants
(vi) Preservatives
(vii) Nutritional supplements such as minerals, vitamins and amino acids.

SWEETENERS	
Natural	**Artificial**
• Adds calories • Not suitable for diabetic patients • Affects tooth	• Doesn’t add calories • Suitable for diabetic patients • Has many adverse affects

Artificial sweetener	**Properties**	**Sweetness compared to cane sugar**
Saccharin	Doesn’t add calories Excreted from body	550 times
Aspartame	Unstable at cooking temperature used only in cold foods	100 times
Alitame	High potency sweetener	2000 times
Sucralose	Trichloro deivative of sucrose stable at cooking temperature	600 times

Food preservatives

- Prevents spoilage of food due to microbial growth such as yeast and fungal growth, increases the shelf life of the food product
- Physical methods of food preservation-keeping in cold environment, heat, dehydration or irradiation
- Chemical method of food preservation-adding salt, sugar, vinegar, sodium benzoate, sorbates, nitrites etc.

Antioxidants

- Retards or prevents oxidation of food
  Eg-BHT,BHA,SO_2,Sulphites
  BHA -Prevents rancidity in butter and increases its shelf life
  SO_2 andSulphites – In alcoholic beverages.

<table>
<tr><th colspan="4">Cleansing agents-Detergents</th></tr>
<tr><td>Soaps-sodium and potassium salts of long chain fatty acids which is difficult for cleansing in hard water (due to the formation of scum)</td><td colspan="3">Synthetic Detergents-suitable in hard water, as well as ice cold water, have properties of soap, but doesn’t contain soap</td></tr>
<tr><td>Medicated soaps</td><td>Cationic detergent</td><td>Anionic detergent</td><td>Non ionic detergent</td></tr>
<tr><td>Shaving soaps</td><td rowspan="6">Quaternary ammonium salts of amines with acetates, chlorides, bromides
Eg:
Cetyltrimethyl ammonium bromide used in hair conditioners</td><td rowspan="6">Sodium salts of sulphonated long chain alcohols or hydrocarbons

Eg
Sodium lauryl sulphate used in toothpaste</td><td rowspan="6">Detergent of Stearic acid and polyethylene glycol is used in dishwashing liquid</td></tr>
<tr><td>Laundry soaps</td></tr>
<tr><td>Transparent soaps</td></tr>
<tr><td>Floating soaps</td></tr>
<tr><td>Toilet soaps</td></tr>
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Questions:	
1	Which of the following is used as an antacid? (a) Iproniazid (b) Salvarsan (c) Zantac (d) Chloramphenicol
2	Drugs that bind to receptor site and inhibit its natural function are called (a) antagonists (b) agonists (c) enzymes (d) molecular targets
3	Allergy is caused by the production of_____ in the body (a) Hormones (b) Enzymes (c) Vitamins (d) Histamines
Assertion: Competitive inhibitors compete with natural substrate for their attachment on the active sites of enzymes. Reason: In competitive inhibition, inhibitor binds to the active site of the enzyme.	
4	Give two examples of macromolecules that are chosen as drug targets.
5	What class of drug is Ranitidine?

LETS TRY…….	
1	Name a substance that can be used as an antiseptic as well as a disinfectant.
2	Bithional added to soap acts as (a) buffering agent (b) antiseptic (c) softener (d) drying
3	Mixture of Chloroxylenol and terpineol acts as (a) antiseptic (b) antipyretic (c) antibiotic (d) analgesics
4	Narcotic analgesic is (a) aspirin (b) paracetamol (c) codeine (d) cimetidine

QUESTIONS	
1	Which one of the following drugs is an antibiotic: Morphine, Equanil, Chloramphenicol, Aspirin
2	Which class of drugs is used in sleeping pills?
3	What is the cause of a feeling of depression in human beings? Name a drug which can be useful in treating this depression.
4	Mention the action of the following on the human body in bringing relief from a disease. (i) Brompheniramine (ii) Aspirin (iii) Equanil
5	While antacids and anti-allergic drugs interfere with the function of histamines, why do these not interfere with the function of each other?