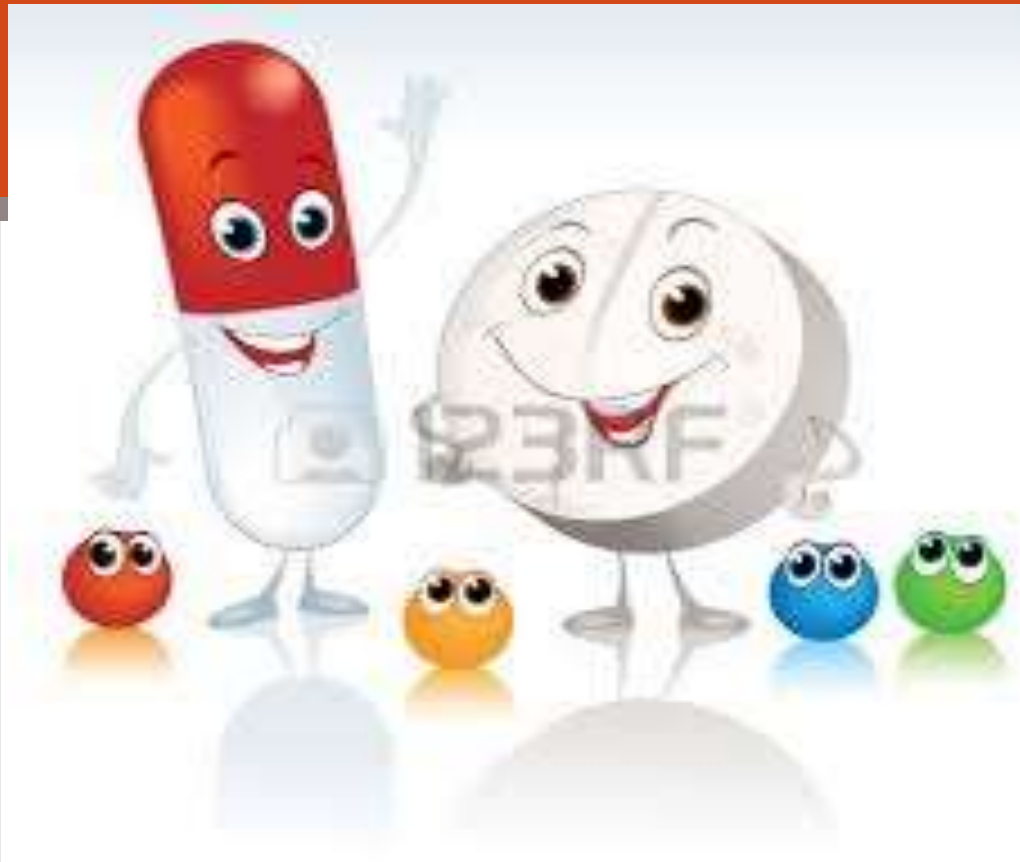


ANTIBIOTICS



Definition:

Antibiotics are the chemical substances derived from or metabolically produced, by living organisms, which are capable of inhibiting the life processes of other microorganisms, in small concentrations.

It also includes the synthetic compounds which are structural analogues of naturally occurring antibiotics.

Ideal qualities of antibiotics:

- It should be effective against wide range of pathogens without producing toxic effects on the host
- It should be stable during isolation, storage and use
- It should have desirable degree of safety
- It should have satisfactory rate of absorption and excretion
- It should be easily obtained
- It should be nontoxic
- It should be cheap

CLASSIFICATION

I Depending upon spectrum of antimicrobial activity :

- a) Narrow spectrum antibiotics: These antibiotics are effective against selective organisms. i.e. gram positive bacteria or gram negative bacteria or certain fungi or yeast
e.g. benzyl penicillin
- a) Broad spectrum antibiotics: These antibiotics are effective against large number of pathogens
e.g. streptomycin, chloramphenicol, tetracyclin

II Depending upon biosynthesis:

a) antibiotics derived from amino acids:

i) From single amino acid e.g. chloramphenicol

ii) From two amino acids e.g. benzyl penicillin

iii) From many amino acids (polypeptide antibiotics) e.g. bacitracin

b) Antibiotics derived from sugars: e.g. streptomycin, neomycin, gentamicin

c) Antibiotics derived from acetates and propanoate units e.g. tetracycline, erythromycin

d) Miscellaneous: e.g. griseofulvin, rifampicin

III Chemical classification

- a) **β -lactum** antibiotics: e.g. benzyl penicillin, phenoxymethyl penicillin, ampicillin, carbenicillin, cloxacillin, cephalexin
- b) **polypeptide** antibiotics: e.g. bacitracin, colistin, polymyxines
- c) **polyene** antibiotics: e.g. nystatin, amphotericin
- d) **aminoglycoside** antibiotics: e.g. streptomycin, kanamycin, neomycin, gentamicin
- e) **macrolide** antibiotics: erythromycin
- f) **tetracyclines**: e.g. tetracycline, chlortetracycline
- g) **ansamycins**: e.g. rifampicin
- h) **miscellaneous**: actinomycin D, cycloserine, griseofulvin, chloramphenicol

β-lactum antibiotics (Penicillins and Cephalosporins)

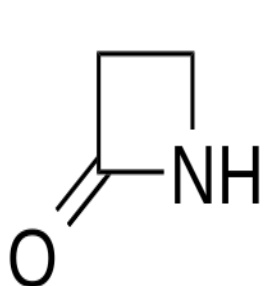
PENICILLINS

- First antibiotic discovered by *Dr. Alexander Fleming*
- Obtained by fermentation using various strains of mould “*Penicillium*”
e.g. *Penicillium notatum*, *Penicillium chrysogenum*
- First semisynthetic penicillin introduced was phenoxymethyl penicillin

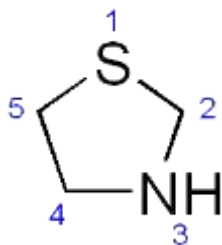


Chemistry of Penicillins

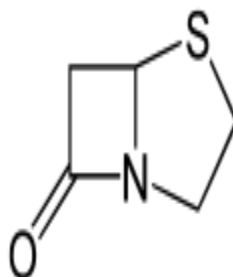
They are derived from '6-amino penicillanic acid' which is fused thiazolidine ring and β -lactum ring



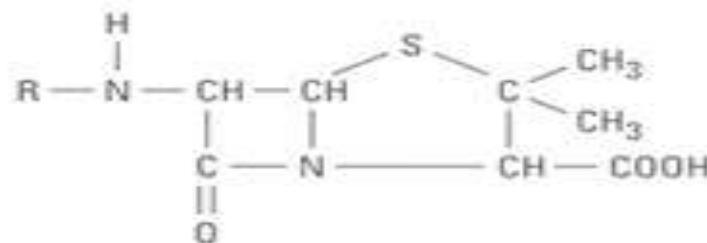
β -lactum



thiazolidine



penam

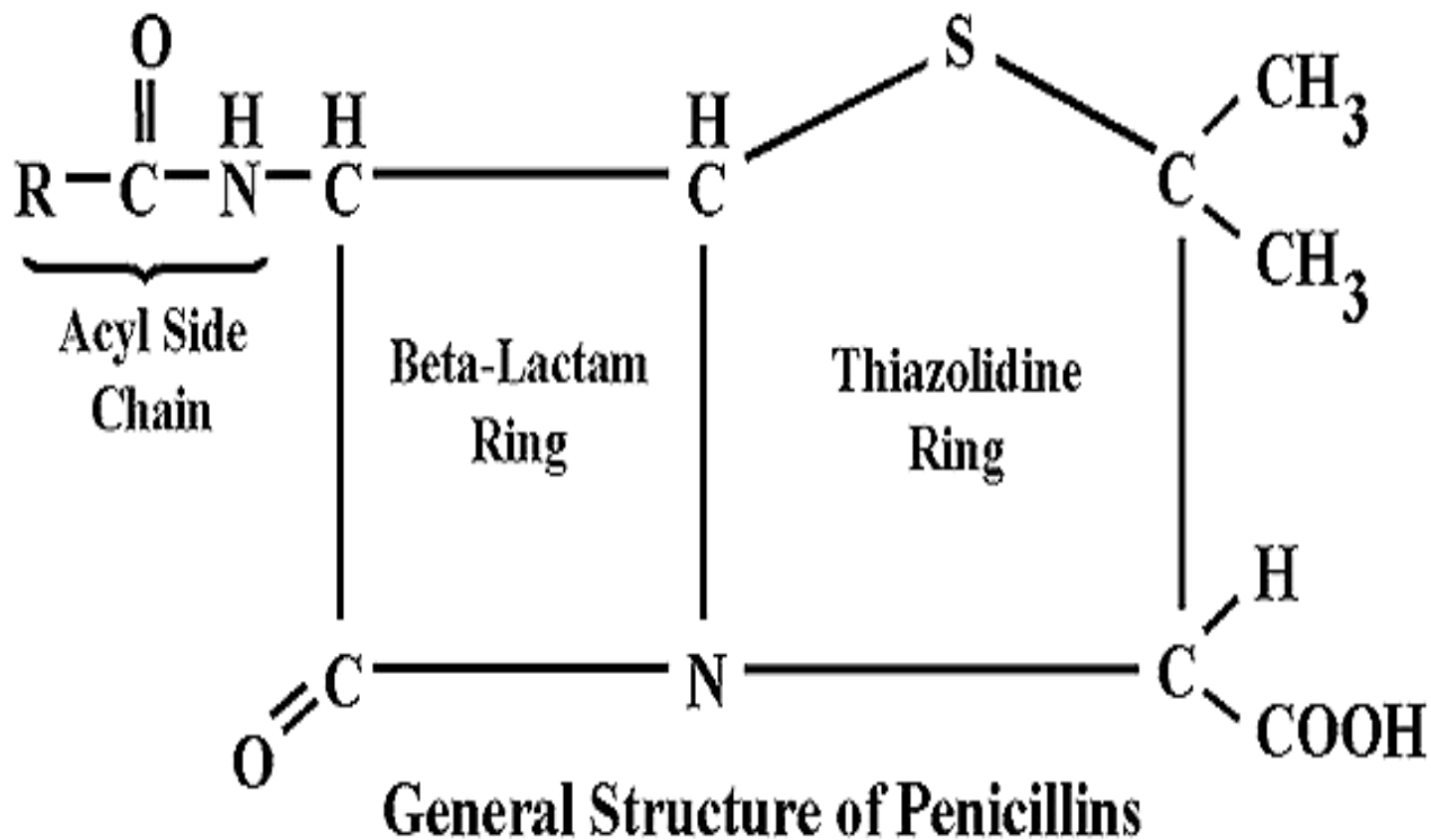


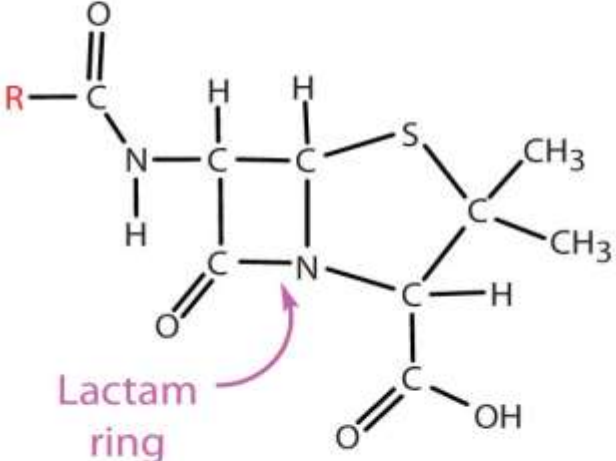
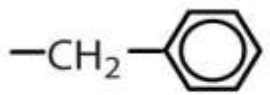
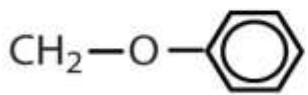
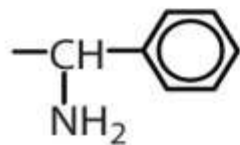
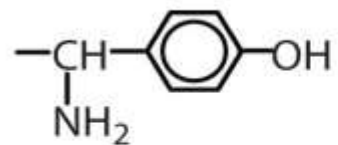
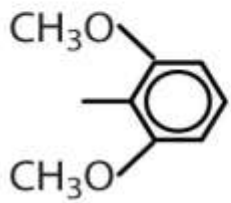
6-amino penicillanic acid

From 6-amino penicillanic acid various salts and esters are prepared.

Natural penicillins are less active and have limited applications as compared to synthetic and semi synthetic penicillins.

Common examples of penicillins

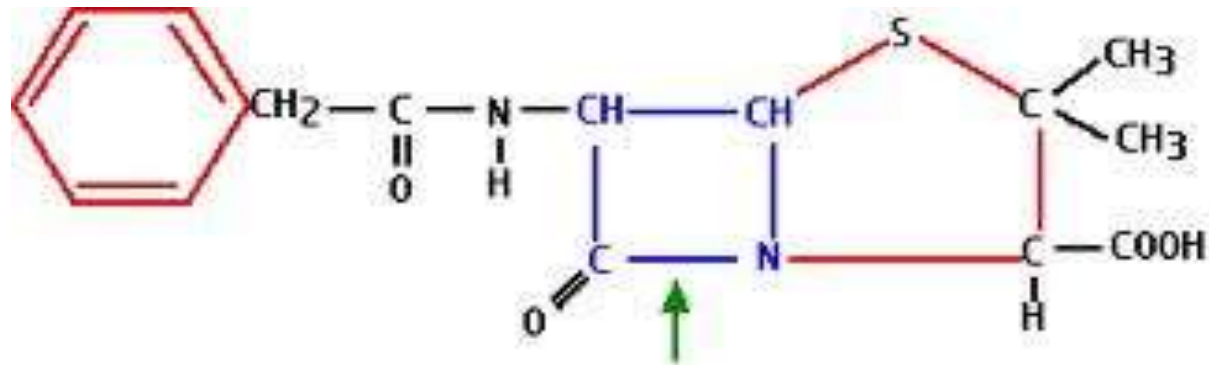


Penicillin Structure	R Group	Drug Name
		penicillin G
		penicillin V
		ampicillin
		amoxicillin
		methicillin

Penicillin G = Benzyl penicillin

Penicillin V = Phenoxy methyl penicillin

Benzyl Penicillin (penicillin G)



Penicillin G

6-(2-phenyl acetamido)penicillanic acid

Or

6-(2-phenyl acetamido)-2,2-dimethyl, penam-3-carboxylic acid

Properties

- White, finely crystalline powder with faint characteristic odour
- Hygroscopic
- Very soluble in water
- Dextrorotatory
- Degraded rapidly in strong acidic and basic media
- Inactivated by enzyme *penicillinase* and gastric juice
- Structural modifications are possible

Stability and Storage

Stored in tightly closed containers protected from moisture

Uses

Effective against gram positive bacteria

➤ Used to treat :

- Abscess
 - Syphilis
 - Gonorrhoea
 - Pharyngitis, pneumonia, meningitis, endocarditis due to staphylococci
- Prophylactically used before dental and surgical procedures to prevent from developing endocarditis and re-occurrence of rheumatic fever

Pharmaceutical formulations:

Benzyl penicillin injection

Benzyl penicillin eye drops

Benzyl penicillin eye ointment


Brand names:

CRYSTAPEN, PENTIDS, PAM



Benzathine Penicillin

It is a N,N'-dibenzyl ethylene diamine salt of benzyl penicillin

- White crystalline powder, odourless and hygroscopic in nature
- Practically insoluble in water but stable at gastric pH
- Due to poor water solubility  greater stability and prolonged duration of action

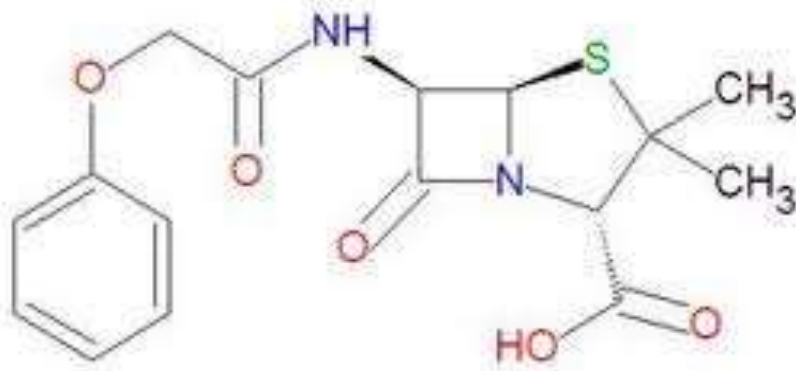
➤ Stored in tightly closed light resistant container at a temperature not exceeding 25°C

➤ Available in the form of tablets, oral suspension, sterile suspension, fortified injection

➤ Brand names: Penidure, Longacillin



Phenoxy methyl Penicillin (penicillin V)



6-(2-phenoxy acetamido)penicillanic acid

Properties

- White, finely crystalline powder, odorless and has slightly bitter taste
- Very slightly soluble in water but freely soluble in alcohol
- Gives uniform concentration in blood
- Resistant to acid hydrolysis

Stability and Storage

Stored in tightly closed containers

Uses

Effective against gram positive bacteria

➤ Used to treat :

- abscess
- Syphilis
- Gonorrhoea
- Pharyngitis, pneumonia, meningitis, endocarditis due to staphylococci

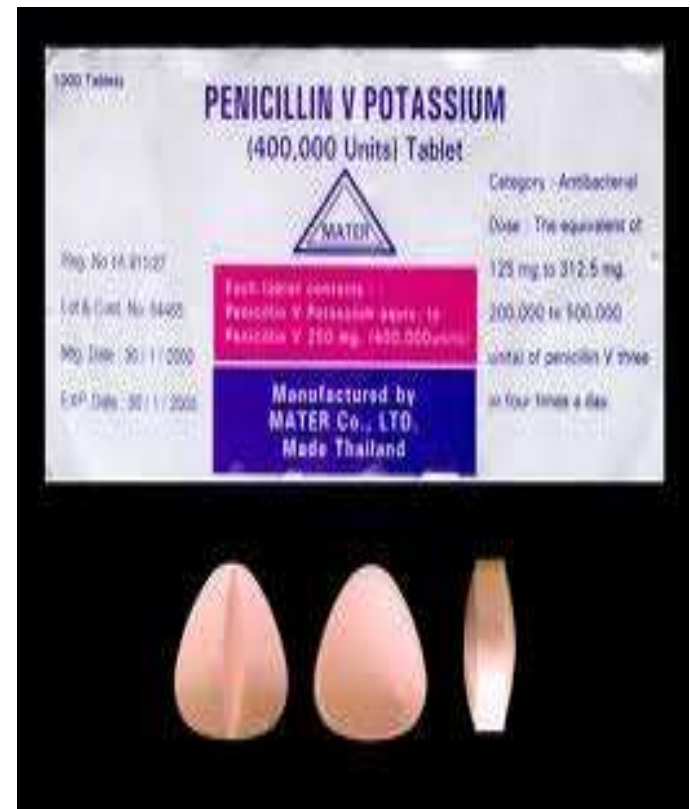
➤ Prophylactically used before dental and surgical procedures to prevent from developing endocarditis and re-occurrence of rheumatic fever

Dosage forms:

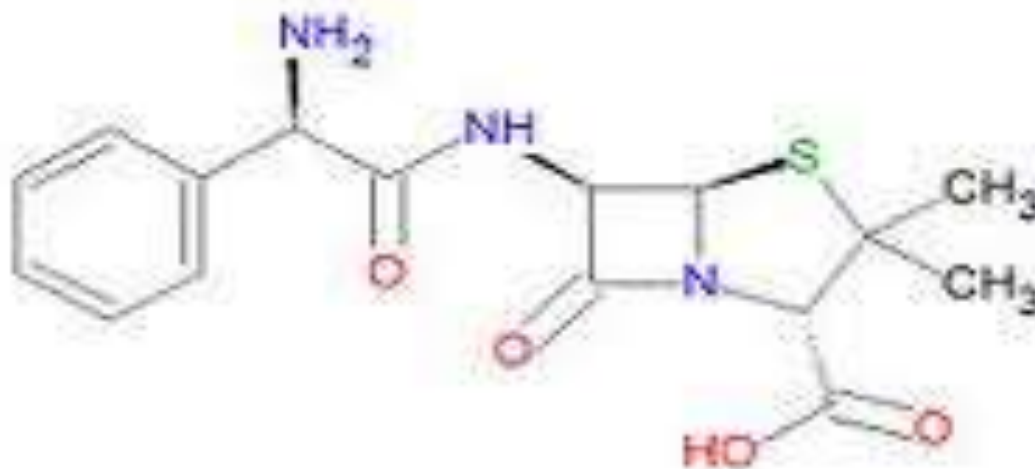
Capsules., tablets and oral suspensions

Brand names:

CRYSTAPEN V, Penitriad, Depen



Ampicillin



6-(2-amino-2-phenyl acetamido)penicillanic acid

Properties

- White crystalline powder, odourless and has bitter taste
- Sparingly soluble in water and very slightly soluble in alcohol

Stability and Storage

Stored in tightly closed container at a temperature not exceeding 25°C

Uses

Used in treatment of

- Respiratory tract infections
- Urinary tract infections
- Gonorrhoea
- Meningitis
- Enteric infections
- Septicemia

Dosage forms:

Capsules., tablets, oral suspensions sterile solutions and injections

Brand names:

Roscillin, Ampillin, Ampipen



Carbenicillin

- White or almost white powder, odourless, hygroscopic in nature and has bitter taste
- Freely soluble in water and Practically insoluble in ether and chloroform
- Stored in tightly closed light resistant container at a temperature not exceeding 5°C
- Used parenterally to treat
 - Respiratory tract infections due to pseudomonas spp.
 - Urinary tract infections
 - Septicemia
- Available in the form of injections.
- Brand names: Carbapen, carbelin

Cloxacillin

It is a semi synthetic penicillin and contains substituted isoxazol-4-yl heterocycle which is bulkier.

- Sodium salt is white crystalline powder, odorless, hygroscopic in nature and has intensely bitter taste
- Freely soluble in water and very slightly soluble in chloroform
- Stored in tightly closed light resistant container at a temperature not exceeding 25°C
- For parenteral administration container should be sterile and sealed
- If not intended for parenteral use, the label should bear “content should not be injected.”

Uses:

- It is an antibacterial agent and used to treat staphylococcal infections which are resistant to benzyl penicillin
- Used in treatment of
 - Respiratory tract infections
 - Urinary tract infections
 - Otitis media
 - Meningitis
 - Endocarditis
 - Septicemia
 - Bone and joint infections



Dosage forms:

Capsules, tablets, suspensions and injections

Brand names:

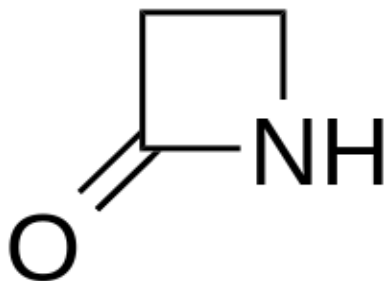
Cloxa –A, cloxin

CEPHALOSPORINS

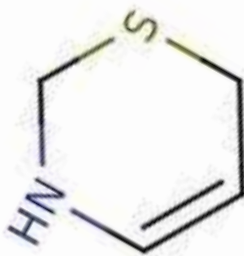
- Obtained from the growth of the strains of *Cephalosporium* fungus
- Also obtained by semi synthetic processes

CHEMISTRY OF CEPHALOSPORIN

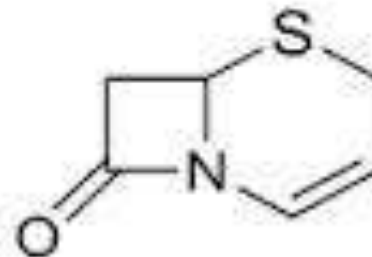
They are derived from '7-aminodihydro cephalosporanic acid' (7ADCA) which is fused dihydrothiazine ring and β -lactum ring



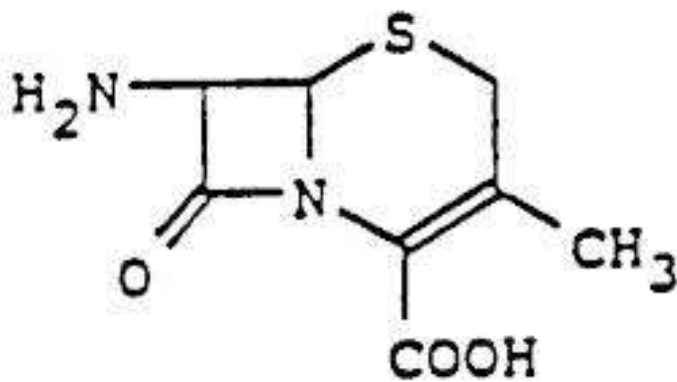
β -lactum



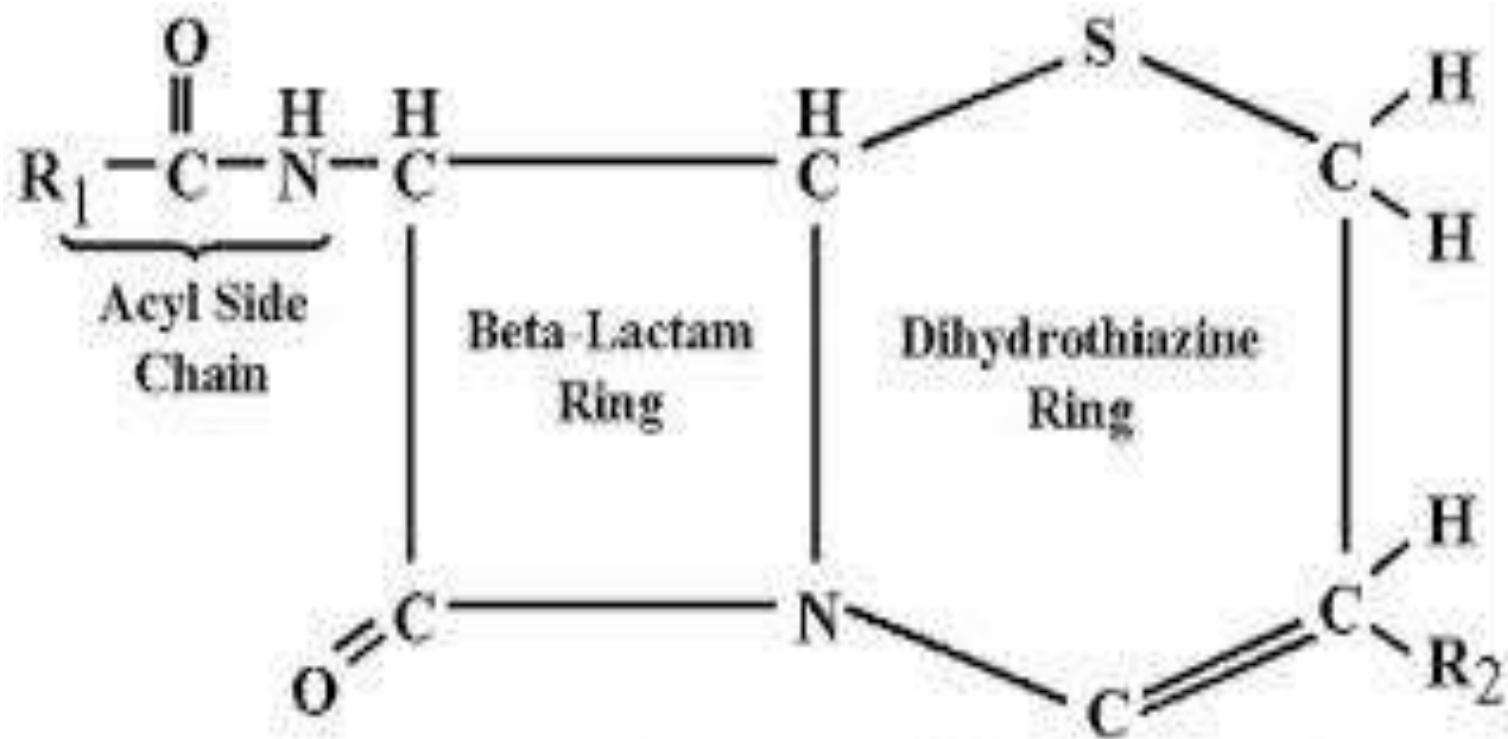
2,3-dihydrothiazine



3-cephem

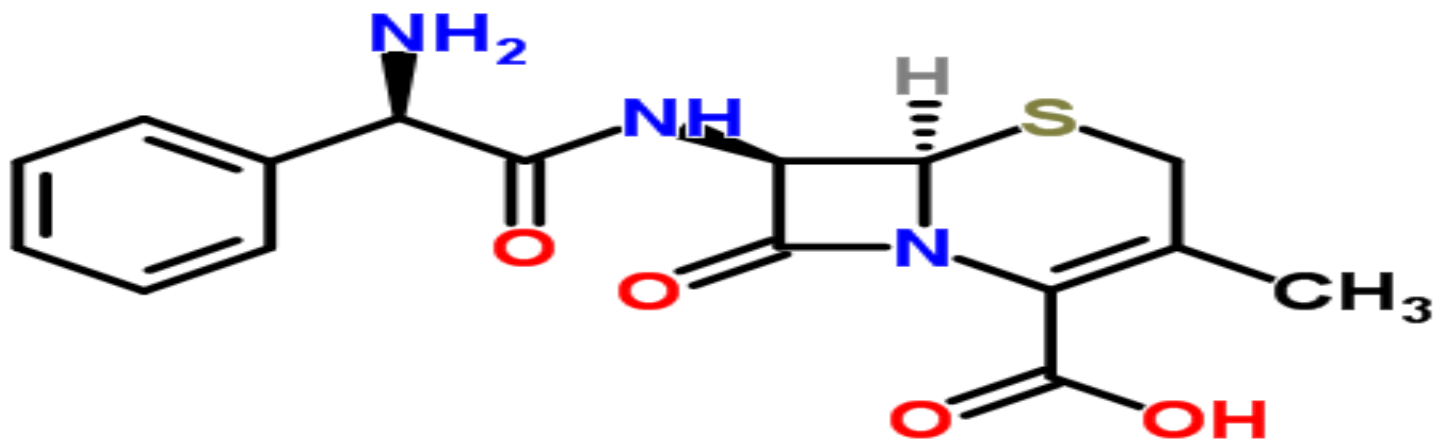


7-aminodihydro cephalosporanic acid



General Structure of Cephalosporins

Cephalexin



Properties

- White or cream coloured crystalline powder, characteristic odour
- Sparingly soluble in water and very slightly soluble in alcohol and in chloroform

Stability and Storage

Stored in tightly closed light resistant container at a temperature not exceeding 30°C

Uses

Used in treatment of

- Respiratory tract infections
- Skin and soft tissue infections

- Otitis media
- Genito-urinary infections
- Dental infections
- Bone and joint infections

Dosage forms:

Capsules., tablets, mixtures

Brand names:

Sepexin , Neocef, Cephaxin

CEPHALORIDINE



www.ChemDrug.com

Properties

- White crystalline powder, slight odour of pyridine and bitter taste
- Freely soluble in water and very slightly soluble in chloroform

Stability and Storage

Stored in sterile tightly closed light resistant container in cool place.
Label should bear whether the contents are α -form or δ -form

Uses

Used in treatment of

- Respiratory tract and urinary tract infections
- Skin and soft tissue infections
- Bone and joint infections

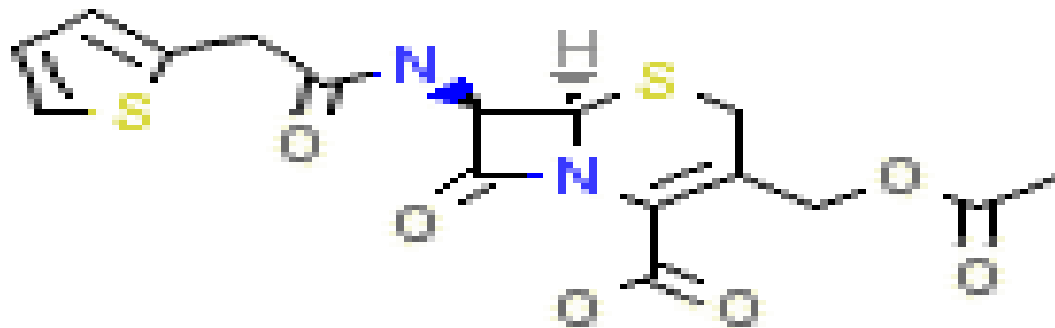
Dosage forms:

Injectons

Brand names:

Cephalodine, cefadine

CEPHALOTHIN



Properties

- White crystalline powder, odourless
- Freely soluble in water and practically insoluble in chloroform

Stability and Storage

Stored in sterile tightly closed light resistant container at a temperature not exceeding 25°C

Uses

Used in treatment of

- Respiratory tract and urinary tract infections
- Skin and soft tissue infections
- Bone and joint infections

Dosage forms:

Injections

Brand names:

Keflin. Seffin

AMINOGLYCOSIDES ANTIBIOTICS

- Aminosugars are linked glycosidically in the structure
- Examples are streptomycin, neomycin, gentamycin, paramomycins

STREPTOMYCIN

First aminoglycoside

Isolated from **streptomyces griseus** or obtained synthetically

Properties

- White powder, odourless, slight bitter taste
- Very soluble in water and sparingly soluble in alcohol
- Strongly basic

Stability and Storage

Stored in wellclosed container protected from moisture at a temperature not exceeding 30°C

Uses

It's a broad spectrum antibiotic used

Orally, to treat intestinal infections of large intestine

Intramuscularly, to treat all forms of tuberculosis

Sometimes intrathecally in tubercular meningitis

Dosage forms:

Injections , tablets

Brand names:

Chlorostrep, Enterostrep, Lykastrep, Streptomex

NEOMYCIN

It is a mixture of three components neomycin A, B and C

Properties

- White or yellowish white powder, hygroscopic in nature
- Freely soluble in water and very slightly soluble in alcohol

Uses

It's a broad spectrum antibiotic used to treat

- Staphylococcal infections of skin and eye
- GI Tract infections on oral administration

To treat patients suffering from hepatic coma to suppress ammonia forming bacteria in GI Tract

Pharmaceutical formulations:

Neomycin cream

Hydrocortisone and neomycin cream

Hydrocortisone and neomycin ear drop

Neomycin eye drops

Neomycin eye ointment

Hydrocortisone and neomycin eye drope

Neomycin, Bacitracin and polymyxin eye drops

Brand names:

Dexeber N, Dexacort- N, Ne-ba- Sulf, Neosporin

GENTAMICIN

It is a mixture of gentamicin C₁, C₂ and C_{1a}. Some samples may contain gentamicin C_{2A} and C_{2B} in significant quantities.

Properties

- White or cream coloured powder,
- Soluble in water and practically insoluble in chloroform

Uses

It's a broad spectrum antibiotic used to treat

- Septicemia including neonatal sepsis
- For prophylaxis and treatment of endocarditis
- For prophylaxis of surgical infections

It is given with other antibiotics to delay the development of resistance

Dosage forms:

Injections , cream, ointment, eye drop

Brand names:

Gentimicin, G-mycin, Gentapar

TETRACYCLINES

Properties

Yellow crystalline powder, odourless, bitter taste

- Very slightly soluble in water and soluble in dilute acid and alkali hydroxides with decomposition
- Leavorotatory

Stability and Storage

It darkens in strong sunlight and in presence of moisture. Hence stored in tightly closed light resistant container

Uses

It's a broad spectrum antibiotic used to treat

Chronic bronchitis, UTI, syphilis, gonorrhoea, rat-bite fever, acne vulgaris and in penicillin hypersensitive patients

- In conjunction with streptomycin used to treat plague
- In combination with fluid and electrolyte replenishers used to treat cholera
- In conjunction with quinine, for management of malaria

Dosage forms:

Capsule, tablets, injections , eye ointment, intravenous infusion

Brand names:

Achromycin, Enterocycline, Cadicycline

MACROLIDE ANTIBIOTICS

ERYTHROMYCIN

It is produced by certain strains of streptomyces erythetus

Properties

- White or yellowish white crystals or crystalline powder, odourless, bitter taste
- Hygroscopic in nature
- Very slightly soluble in water and soluble in dilute hydrochloric acid

Stability and Storage

Stored in tightly closed light resistant container at a temperature not exceeding 30°C

Uses

It's a broad spectrum antibiotic used to treat

Syphilis, gonorrhoea, in penicillin allergic patients

Drug of choice to treat pneumonia, urethritis, pelvic inflammation

To treat amoebic dysentery

Also used to treat wounds and burn infections, infected eczema, acne vulgaris

Dosage forms:

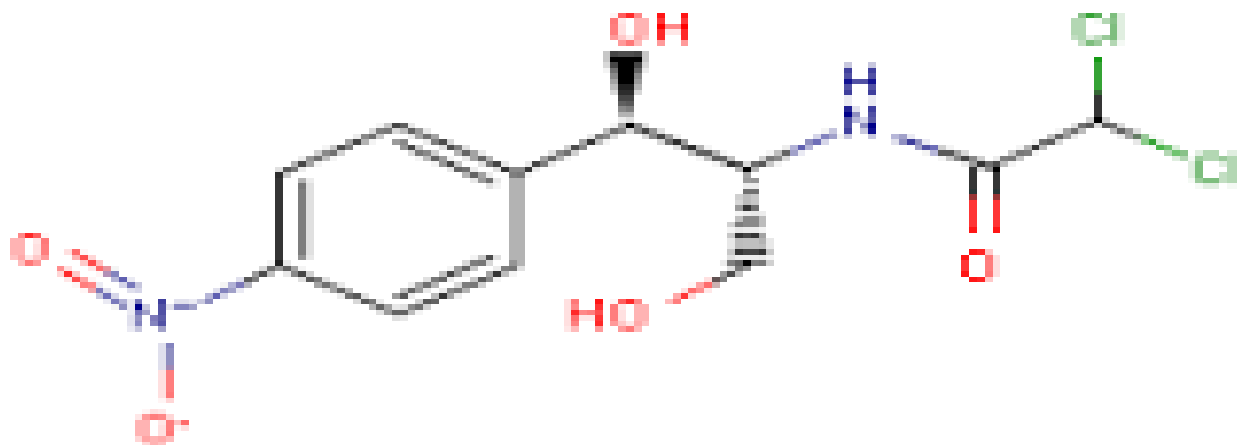
Tablets, injections , soluble powder, capsules

Brand names:

Erythrocin, Althrocin

MISCELLANEOUS ANTIBIOTICS

CHLORAMPHENICOL



Properties

- White or grayish white or yellowish white crystals or crystalline powder, odorless, very bitter taste
- Slightly soluble in water and freely soluble in alcohol and in propylene glycol

Stability and Storage

Stored in well closed light resistant container

Uses

It's a broad spectrum antibiotic used to treat

Typhoid and paratyphoid fever

Meningitis, UTI

Rickettsial infections

Eye and ear infections

Superficial skin infections

septicemia

Pharmaceutical formulations:

Chloramphenicol capsules

Chloramphenicol ear drop

Chloramphenicol eye ointment

Chloramphenicol injection

Chloramphenicol palmitate suspension

Brand names:

Chlorostrep, Enterostrep, Enteromycin, O-mycin

GRISEOFULVIN

Properties

- White or pale cream coloured powder, odorless, tasteless
- Very slightly soluble in water, soluble in acetone and freely soluble in tetrachloroethane

Uses

It has an antifungal action against wide range of dermatophytoses.

Used in treatment of infections caused by ringworms, trichophyton spp., epidermophyton spp. and microsporun spp.

Dosage forms:

Tablets, capsules, oral suspension

Brand names:

Grisovin, Bifulvin, Fungivin