**Antibiotic:-** are medicines that destroy or slow down the growth of bacteria.

Since Alexander Fleming accidentally discovered penicillin in 1929, the numbers of antibiotics that have been added to our therapeutic armamentarium has grown tremendously.

Because of the overuse of many of these agents and the biochemical fickleness of many bacteria, resistance to antibiotics has become a serious problem in the 21st century.

**Classification of antibiotic**

Antibiotic are classified in many ways based on chemical structure, source, and its spectrum of activity and mechanism of action.

**Based on chemical structure (chemical classification)**

1. β-lactam antibiotic: Penicillins, cephalosporins, carbapenams, momobactams
2. aminoglycoside antibiotics:- streptomycin, neomycin, kanamycin, gentamycin, tobramycin, amikacin.
3. Tetracyclines:- tetracycline, chlortetracycline, oxytetracycline, doxycycline, minocycline, methacycline, meclocycline.
4. Macrolide: erythromycin…etc.
5. Lincomycin:- Clindamycin.
6. Polypeptides: Vancomycin…etc.
7. Unclassified antibiotics: chloramphenicol
8. Newer antibiotics: Aztreonam.

# β-LACTAM ANTIBIOTICS

Antibiotics that possess the β-lactam (a four-membered cyclic amide) ring structure are the dominant class.



β

α

The name ***beta- lactam*** is due to the fact that the nitrogen atom is attached to β-carbon atom relative to the carbonyl.

There are four groups of beta-lactam antibiotics:-

1. **Penicillins:-** The beta lactam ring is joined to a five-membered thiazolidine ring.



1. **Cephalosporins:-** The beta lactam ring is joined to a six membered dihydrothiazine ring.



1. **Carbapenams:-**- The beta lactam ring is also joined to a five-membered ring .



1. **Momobactams**:- have a monocyclic beta- lactam structure, and a side sulfo-group is joined to a nitrogen atom.



**All of these contain a four-membered beta-lactam ring, which is necessary for exhibiting antibacterial activity.**

## **Penicillins**



They are group of antibiotics that are commonly used in the treatment of different types of gram positive and gram-negative bacterial infections.

-These compounds differ chemically in the acid moiety of the amide side chain.Variations in this moiety produce differences in antibiotic effect and in physicochemical properties, including stability.

**Mechanism of Action**

**There are many properties contribute to the importance of β-lactam antibiotics in chemotherapy:-**

1. They are broad spectrum antibiotics.
2. A potent and rapid bactericidal action against bacteria in the growth phase
3. Very low frequency of toxic and other adverse reactions in the host.

-The uniquely lethal antibacterial action of these agents has been attributed to a selective inhibition of bacterial cell wall synthesis.

-The synthesis of cell wall of bacteria is completely depended upon an enzyme named as transpeptidase.

-Primarily, Penicillin inhibits the cell wall synthesis of bacteria by blocking transpeptidase after binding to penicillin-binding protein (PBP) and prevents its synthesis.

**Nomenclature**

Two numbering systems for the fused bicyclic heterocyclic system exist

1. **Chemical abstract system(CAS):-**

According to this system, penicillins are numbered starting from “S” atom. Sulfur atom is assigned the 1st position and “N” atom is assigned the 4th position.

1. **Nomenclature United states Pharmacopoeia (USP system):-**

This numbering system is the reverse of CA system. According to this system the nitrogen atom is given the 1st position and “S” atom is assigned the 4th position.



Three simplified forms of penicillin nomenclature have been adopted for general use.

1. The name “**penam**” for the unsubstituted bicyclic system, including the amide carbonyl group.



1. Seen more frequently in the medical literature, the name “**penicillanic acid”** to describe the ring system with substituents that are generally present (i.e., 2, 2-dimethyl and 3-carboxyl).



3- A third form uses trivial nomenclature to name the entire **6-carbonylaminopenicillanic acid** portion of the molecule **penicillin**, and then distinguishes compounds based on the **R** group of the acyl portion of the molecule.

