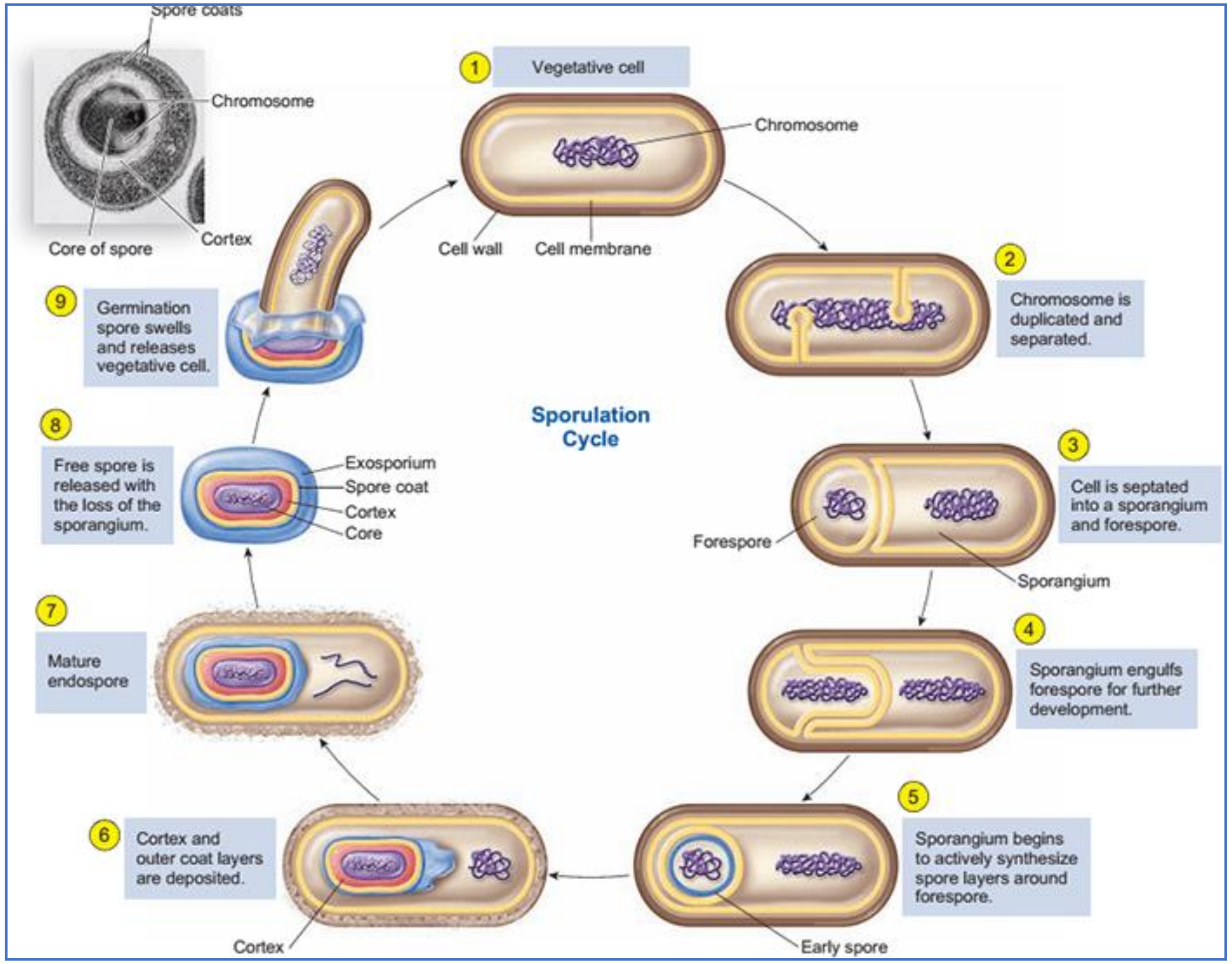
Endospore	Exospore
Spores within cells	Spores outside cells
Thick-walled, highly refractile bodies	Thick-walled, highly refractile bodies
Bacillus, Clostridium sp.	Methane-oxidizing genus (*Methylosinus sp.*)
Grown in rich medium when there is no active growth.	External to vegetative cell, budding at one end of the cell.
Heat/aging activates dormant spores	Heat/aging activates dormant spores
Resistant to desiccation, staining, radiation, heat, disinfecting chemicals.	Resistant to desiccation, staining, radiation, heat, disinfecting chemicals.
Presence of dipicolinic acid as a complex with Ca at the core (helps in heat resistance)	Absence of DPA

Cysts: dormant thick cell-walled, desiccation-resistant forms that develop by differentiation of a vegetative cell and which can later germinate under suitable conditions.
They are different from endospores with respect to chemical composition and structure and are not heat-resistant.
Eg. Azotobacter sp. produces cysts.



Characteristics of endospore-forming bacteria

1. The endospore-forming bacteria are rod-shaped.
2. Few may be cocci.
3. Range from aerobic to facultatively anaerobic.
4. Most of the anaerobes live by fermentation.
5. Few respire anaerobically with sulphate.
6. Mostly are Gram-positive; few may be Gram-negative.
7. Motility is performed by peritricous flagella.
8. Two types: (1) aerobic/facultatively anaerobic spore-forming rods & cocci (eg. Bacillus sp.)
   (2) anaerobic spore-forming rods (eg. Clostridium sp.)

Aerobic/facultatively anaerobic spore-forming	Anaerobic spore-forming bacteria
Rod-shaped	Rod-shaped
Harmless saprophytes	
Live in soil, water	Live in sediments, human tracts.
Form exocellular enzymes	Characterized by proteolytic activity, acid production, enzyme activities, acid production.

Mycelium

1. Mycelium is the vegetative part of a fungus or fungus-like bacterial colony, consisting of a mass of branching, thread-like hyphae. The mass of hyphae is sometimes called shiro, especially within the fairy ring fungi.
2. Fungal colonies composed of mycelium are found in and on soil and many other substrates. A typical single spore germinates into a monokaryotic mycelium, which cannot reproduce sexually; when two compatible monokaryotic mycelia join and form a dikaryotic mycelium, that mycelium may form fruiting bodies such as mushrooms. A mycelium may be minute, forming a colony that is too small to see, or may grow to span thousands of acres as in Armillaria.

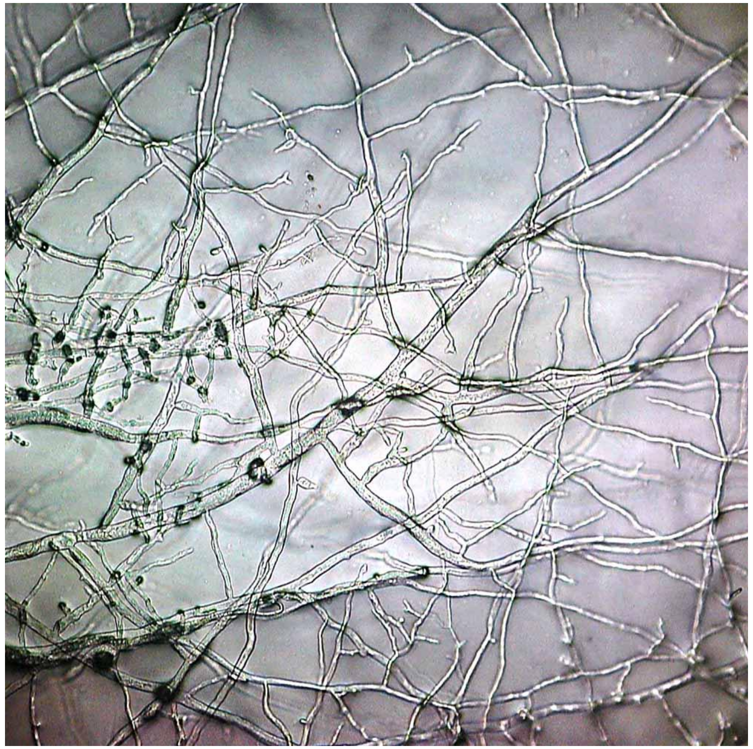
3. Through the mycelium, a fungus absorbs nutrients from its environment. It does this in a two-stage process. First, the hyphae secrete enzymes onto or into the food source, which break down biological polymers into smaller units such as monomers. These monomers are then absorbed into the mycelium by facilitated diffusion and active transport.

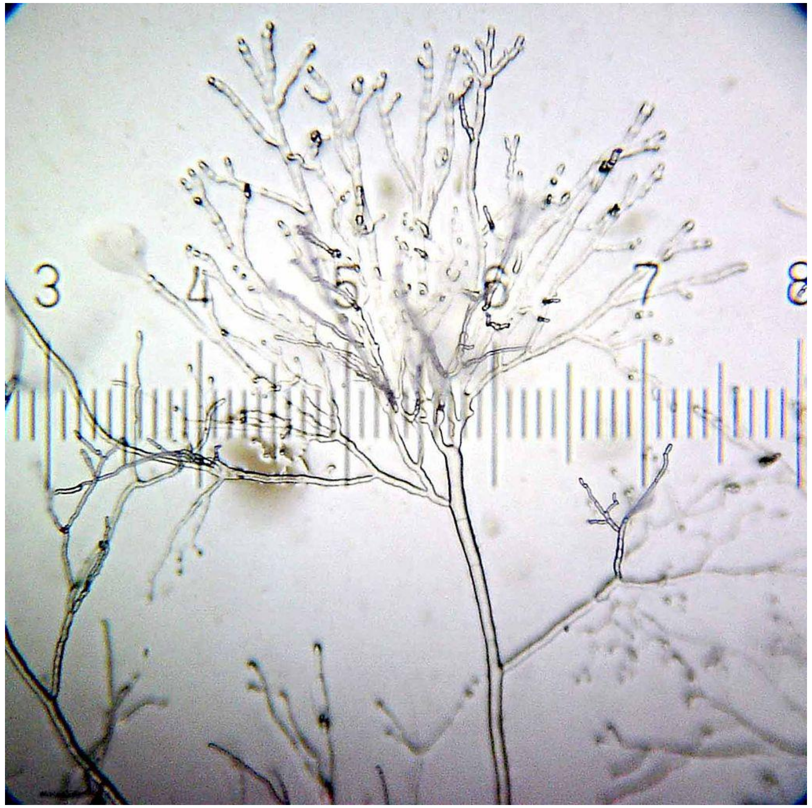
4. Mycelia are vital in terrestrial and aquatic ecosystems for their role in the decomposition of plant material. They contribute to the organic fraction of soil, and their growth releases carbon dioxide back into the atmosphere.

5. Ectomycorrhizal extramatrical mycelium, as well as the mycelium of arbuscular mycorrhizal fungi increase the efficiency of water and nutrient absorption of most plants and confers resistance to some plant pathogens. Mycelium is an important food source for many soil invertebrates.

6. "Mycelium", like "fungus", can be considered a mass noun, a word that can be either singular or plural. The term "mycelia", though, like "fungi", is often used as the preferred plural form.

7. Sclerotia are compact or hard masses of mycelium.




3
4
5
6
7
8

1. The Actinomycetes or Streptomycetes or Actinomycetales as they are called are a group or Gram-positive bacteria which form branched filamentous hyphae having resemblance with fungal hyphae. But their hyphal diameter is approximately 1µm, whereas in fungi it is 5 to 10 µm.

2. Actinomyces species are ubiquitous, occurring in soil and in the microbiota of animals, including the human microbiota.

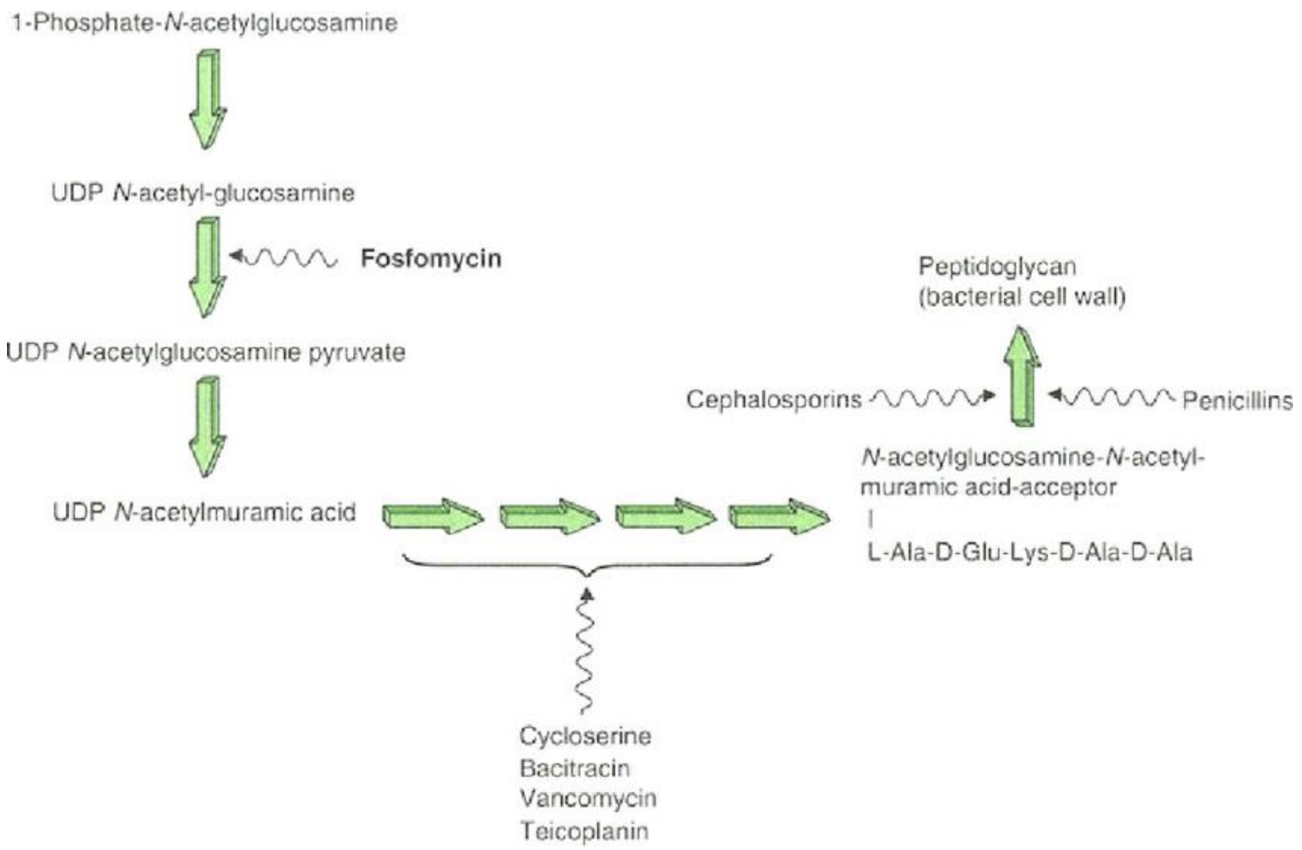
3. Actinomycetes are microorganisms intermediate in form and function between bacteria and fungi. They are heterotrophic organisms that thrive on decomposable organic matter and proliferate in soils that are rich with plant and animal residues.

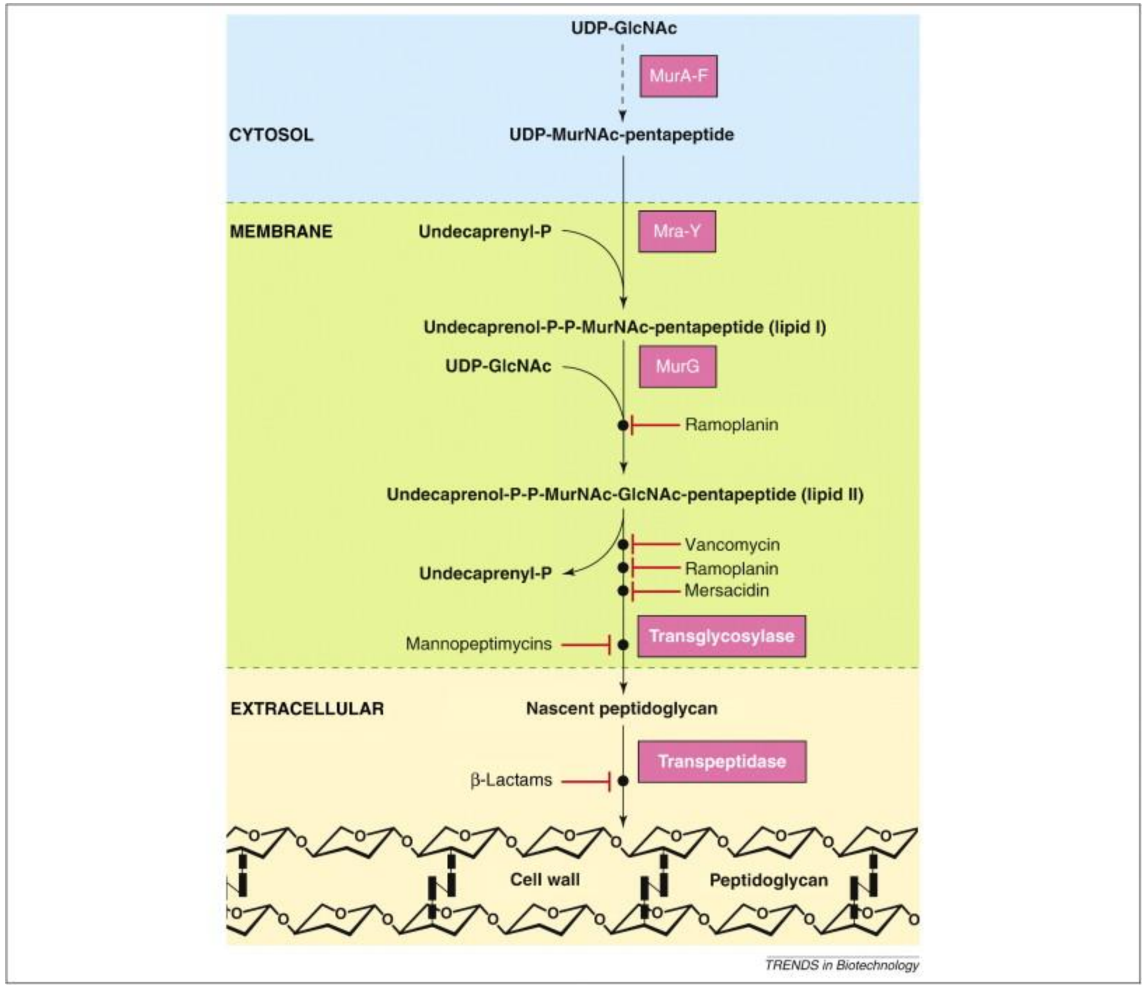
4. Actinomycetes reproduce by producing chains of spores and their tips (via spores), while other filamentous species fragment into new cells. Hyphal growth is followed by fragmentation and release of spores. ... Another form of reproduction is Conidia, which is when spores produce asexually on aerial fillaments

5. Actinomycetes are one of the most important microorganisms that produce a wide variety of useful secondary metabolites, many of which have potent biological activities, including many commercially important antibiotics and immunosuppressive compounds.

6. Some soil actinobacteria (such as Frankia) live symbiotically with the plants whose roots pervade the soil, fixing nitrogen for the plants in exchange for access to some of the plant's saccharides. Other species, such as many members of the genus Mycobacterium, are important pathogens.

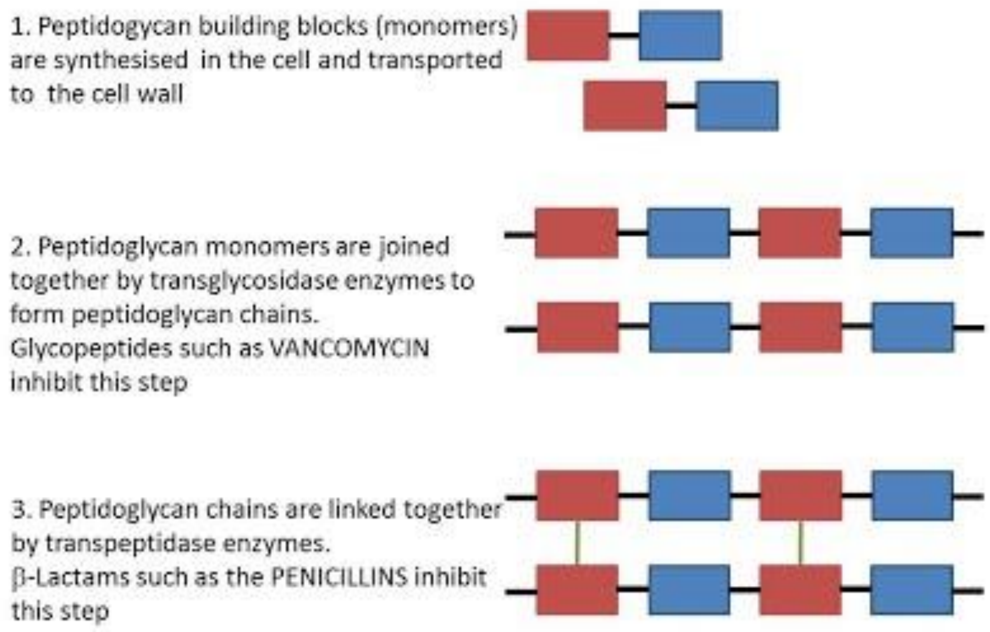
Bacterial Cell Wall Synthesis





Peptidoglycan (murein) is a polymer consisting of sugars and amino acids that forms a mesh-like layer outside the plasma membrane of most bacteria, forming the cell wall. The sugar component consists of alternating residues of β-(1,4) linked N-acetylglucosamine (NAG) and N-acetylmuramic acid (NAM). Attached to the N-acetylmuramic acid is a peptide chain of three to five amino acids. The peptide chain can be cross-linked to the peptide chain of another strand forming the 3D mesh-like layer.[1] Peptidoglycan serves a structural role in the bacterial cell wall, giving structural strength, as well as counteracting the osmotic pressure of the cytoplasm. Peptidoglycan is also involved in binary fission during bacterial cell reproduction.

The peptidoglycan layer is substantially thicker in Gram-positive bacteria (20 to 80 nanometers) than in Gram-negative bacteria (7 to 8 nanometers).[2] Peptidoglycan forms around 90% of the dry weight of Gram-positive bacteria but only 10% of Gram-negative strains. Thus, presence of high levels of peptidoglycan is the primary determinant of the characterisation of bacteria as Gram-positive.[3] In Gram-positive strains, it is important in attachment roles and serotyping purposes.[4] For both Gram-positive and Gram-negative bacteria, particles of approximately 2 nm can pass through the peptidoglyca



The peptidoglycan layer in the bacterial cell wall is a crystal lattice structure formed from linear chains of two alternating amino sugars, namely N-acetylglucosamine (GlcNAc or NAGA) and N-acetylmuramic acid (MurNAc or NAMA). The alternating sugars are connected by a β-(1,4)-glycosidic bond. Each MurNAc is attached to a short (4- to 5-residue) amino acid chain, containing L-alanine, D-glutamic acid, meso-diaminopimelic acid, and D-alanine in the case of Escherichia coli (a Gram-negative bacterium) or L-alanine, D-glutamine, L-lysine, and D-alanine with a 5-glycine interbridge between tetrapeptides in the case of Staphylococcus aureus (a Gram-positive bacterium). Peptidoglycan is one of the most important sources of D-amino acids in nature.

Cross-linking between amino acids in different linear amino sugar chains occurs with the help of the enzyme DD-transpeptidase and results in a 3-dimensional structure that is strong and rigid. The specific amino acid sequence and molecular structure vary with the bacterial specie

Penicillins and cephalosporins are the major antibiotics that inhibit bacterial cell wall synthesis. They are called beta-lactams because of the unusual 4-member ring that is common to all their members.