

Bacterial Cell Organization: Components External to the Cell Wall

By- Dr. Ekta Khare

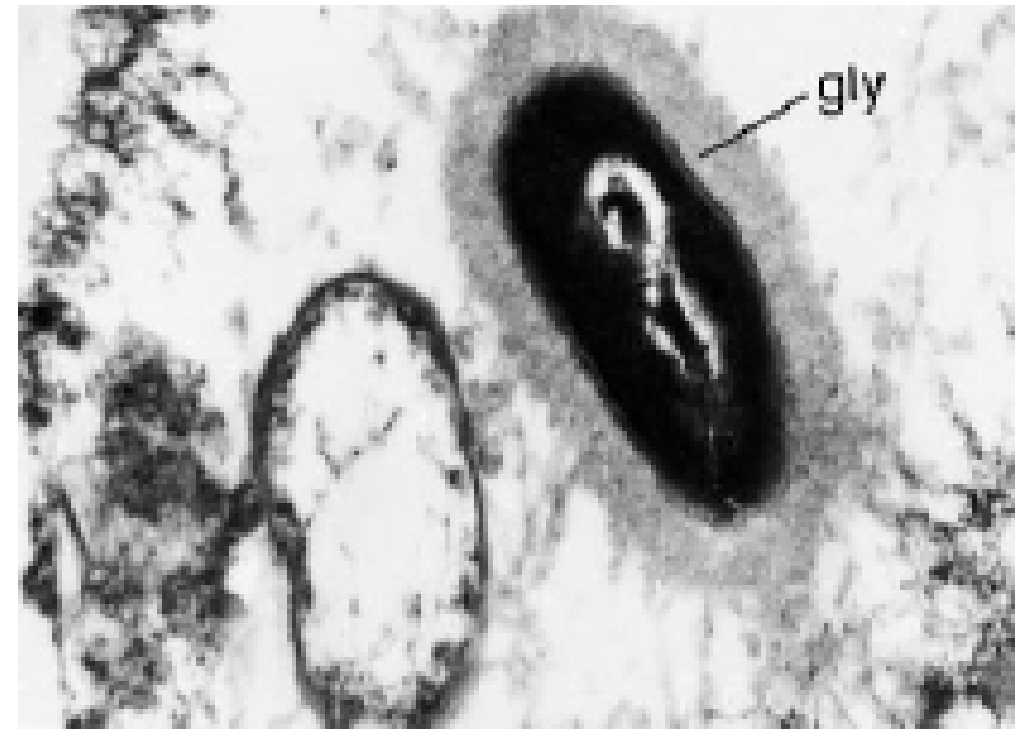
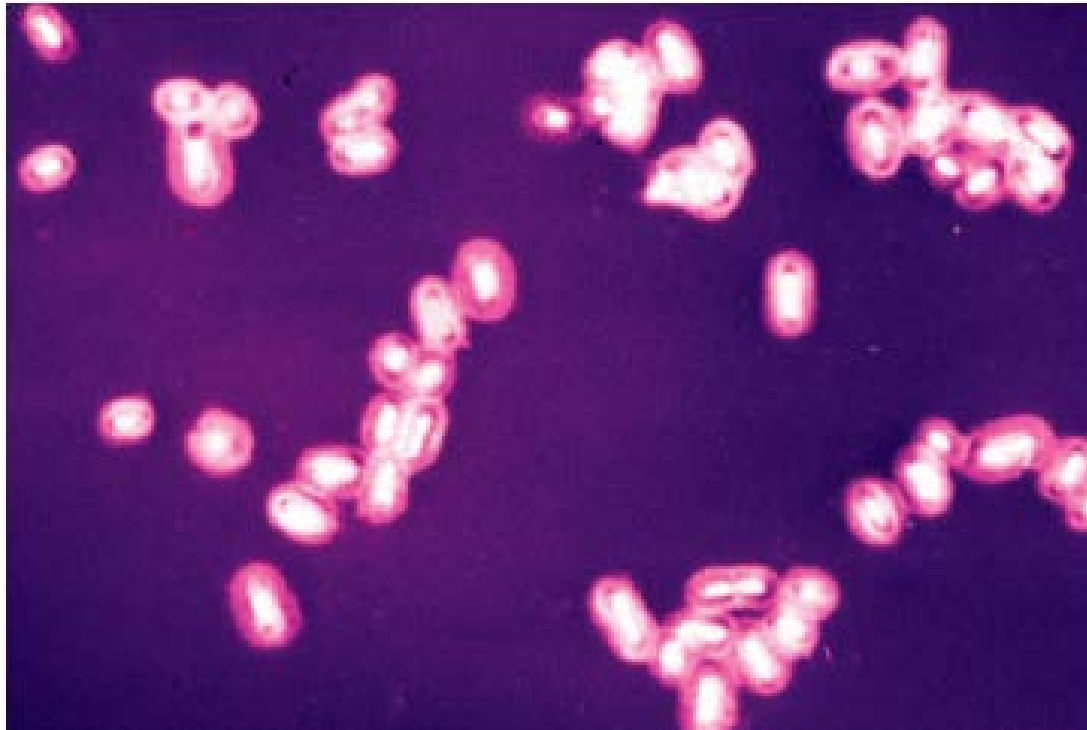
Components External to the Cell Wall

- Bacteria have a variety of structures outside the cell wall that can function in:
 - protection,
 - attachment to objects, and
 - cell movement

Glycocalyx, Capsules, Slime Layers

- Some bacteria have a layer of material lying outside the cell wall.
- When the layer is well organized and not easily washed off, it is called a **capsule**.
- **A slime layer is a zone of diffuse, unorganized** material that is removed easily.
- A **glycocalyx** is a network of polysaccharides extending from the surface of bacteria and other cells (in this sense it could encompass both capsules and slime layers).
- Capsules and slime layers usually are composed of polysaccharides, but they may be constructed of other materials. For example, *Bacillus anthracis* has a capsule of poly-D-glutamic acid.

- Capsules are clearly visible in the light microscope when negative stains or special capsule stains are employed; they also can be studied with the electron microscope.



Capsule

- Although capsules are not required for bacterial growth and reproduction in laboratory cultures, they do confer several advantages when bacteria grow in their normal habitats.
- They help bacteria resist phagocytosis by host phagocytic cells.
- *Streptococcus pneumoniae* provides a classic example.
 - *When it lacks a capsule*, it is destroyed easily and does not cause disease,
 - whereas the capsulated variant quickly kills mice.
- Capsules contain a great deal of water and can protect bacteria against desiccation.
- They exclude bacterial viruses and most hydrophobic toxic materials such as detergents.
- The glycocalyx also aids bacterial attachment to surfaces of solid objects in aquatic environments or to tissue surfaces in plant and animal hosts .
- **Gliding bacteria** often produce slime, which presumably aids in their motility.

S-layer

- Many gram-positive and gram-negative bacteria have a regularly structured layer called an **S-layer** on their surface.
- **S-layers** also are very common among Archaea, where they may be the only wall structure outside the plasma membrane.
- The S-layer has a pattern something like floor tiles and is composed of **protein or glycoprotein**.
- In gram-negative bacteria the S-layer adheres directly to the outer membrane; it is associated with the peptidoglycan surface in gram-positive bacteria.
- It may protect the cell against ion and pH fluctuations, osmotic stress, enzymes, or the predacious bacterium *Bdellovibrio*.
- *The* S-layer also helps maintain the shape and envelope rigidity of at least some bacterial cells.
- It can promote cell adhesion to surfaces.
- Finally, the layer seems to protect some pathogens against complement attack and phagocytosis, thus contributing to their virulence.