

# Comparing Prokaryotic Cells – Variant Structures:

## 1. Cell Wall (multiple barrier support themes)

- Found in almost every prokaryote with the exception of some archaea and mycoplasmas.
- The total structure that defines the exterior of the cytoplasm. It includes the cytoplasmic membrane and one or two other layers in most prokaryotes.
- Estimated 2 atmospheres of turgor pressure due to the cytosol.
- Primary support mechanism (rigidity, strength, shape) is peptidoglycan, aka murein. This layer is composed of a thin sheet of 2 sugars, NAG and NAM and various amino acids. Approx. est. Gram + = 90%, Gram - = 10% of cell wall.

### Peptidoglycan Diversity:

- Found only in bacteria, and not all have DAP (Diaminopimelic acid). DAP is present in all Gram - bacteria and some Gram + bacteria. Most Gram + have lysine instead of DAP and a few Gram + bacteria have other aa's.
- No peptidoglycan in archaea and eucarya because no NAM or DAP.
- Differences are found primarily in the aa interbridge. General scheme of NAG and NAM, with NAM cross-linked to amino acids is universal, aka glycan tetrapeptide.
- Penicillin inhibits synthesis of peptidoglycan by stopping transpeptidase.

### Gram + bacteria:

- Have up to 25 layers of peptidoglycan along with *teichoic* and *lipoteichoic* acids. These have lots of negative charge and may function in ion transport through cell wall.

## **Gram - bacteria:**

- Outer membrane with LPS endotoxin (i.e., Lipid A, core-, & O-polysac)
- Porins & exoenzymes

## **Archaea:**

- Pseudopeptidoglycan with  $\beta$  1-3 linkage
- S layer is paracrystalline in nature

### 2. Endospores (heavy-duty life support strategy)

- *Dipicolinic Acid*, less water, & lower pH
- Heat Resistant

### 3. Bacterial Flagella (appendages for movement)

- Different types, e.g., peritrichous, lophotrichous, & monotrichous
- Protein subunit – flagellin (Not 9+2 microtubule structure!)
- Moves like a propeller, enables chemotaxis

### 4. Gas Vesicles (buoyancy compensation devices)

- Found in planktonic & usually phototrophic bacteria & archaea

### 5. Capsules/Slime Layer (exterior to cell wall)

- Can aid in pathogenesis & protection (Rem: Griffith's Mice expmt)

### 6. Inclusion Bodies (granules for storage)

- Multiple type of materials can be stored depending upon the metabolic menu

### 7. Pili (conduit for genetic exchange)

- One way process for genetic exchange