

## Gram (+)

90% of the cell wall consists of peptidoglycan. Many bacteria especially Gram(+), have several (up to 25) peptidoglycan layers.

differences between Gram(+) & Gram(-)

## Gram (-)

10% is peptidoglycan. the majority of the wall consisting of a complex layer.

In proteins, amino acid are always L-configuration

Bacteria cell wall also has two amino acids that have D-configuration. D-Ala and D-Glu.

The shape of both gram(+) & gram(-) determined by: -length of peptidoglycan chain - manner & extent of cross-linking of the chains.

only present in bacteria

Diversity in peptidoglycan

Other gram(+) have other amino acids.

Most gram(+) have <sup>cell wall</sup> lysine instead of DAP.

DAP (diaminopimelic acid) present in all gram(-), and some gram(+) species

Lam & DAP never found in the cell walls of Archaea or Eukaryotes

Not all bacteria have DAP in their peptidoglycan

Gram(-) contain an additional wall layer made of lipopolysaccharide (LPS).

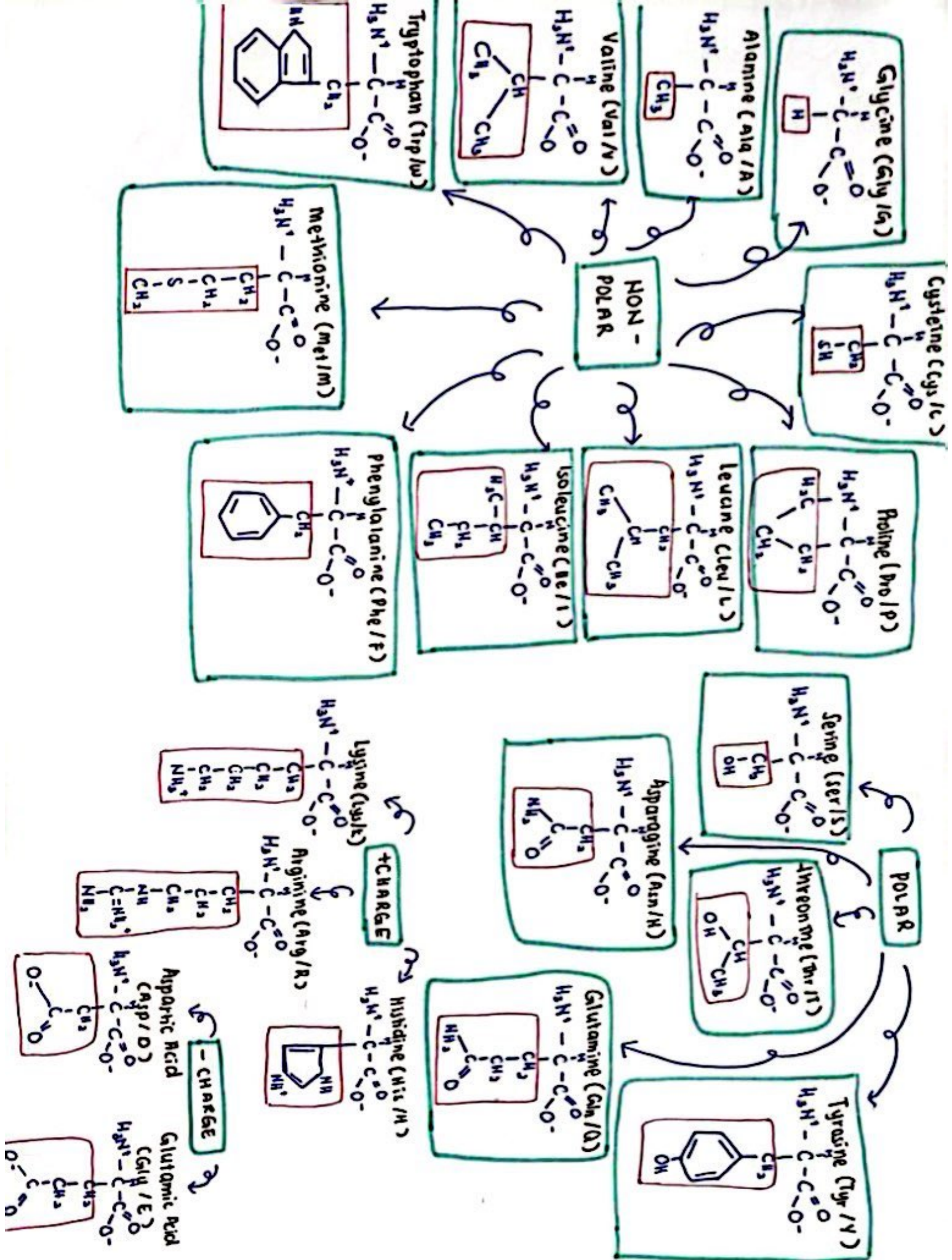
The outer membrane of Gram(-) Bacteria.

LPS is a second lipid bilayer, but it is not constructed solely of phospholipid,

contains polysaccharide and protein

The lipids and polysaccharides are intimately linked in the outer layer forming specific LPS structures.





LPS layer (lipopolysaccharide)

core

outer

P.S core in Salmonella

- Ketodeoxytonate
- 7-C sugars
- glucose
- galactose
- NAG

LPS 3 units

① Lipid A endotoxins

- ↳ embeds LPS layer in outer leaflet
- ↳ has toxic effects that is released during cell's death

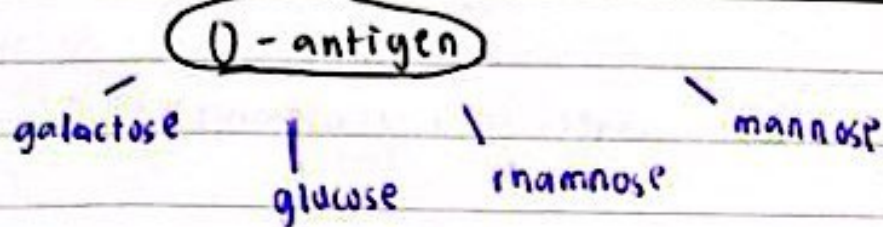
② Core polysaccharide

- ↳ 5 sugars that linked thru KDO to lipid A

③ O-antigen (outer)

- ↳ repeating units of 3-5 sugars
- ↳ hydrophilic





### LPP (lipoprotein)

- ↳ found in inner side of - Gram outer membrane
- ↳ acts as an anchor between outer & peptidoglycan

### Gram staining principles

↳ insoluble crystal violet-iodine complex is extracted by alcohol (-) Gram, not +

(+) Gram → pores in walls close due to wall become by alcohol

→ crystal violet - iodine stays inside wall

(-) Gram → alcohol readily penetrates, lipid

→ thin peptidoglycan layer makes crystal violet-iodine complex to easily escape