

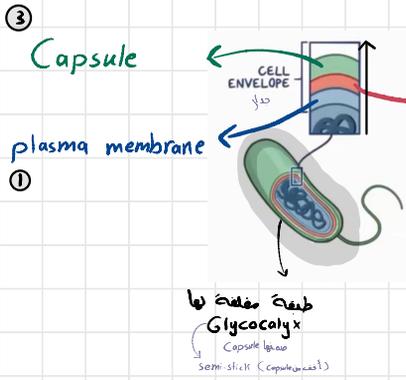


# BACTERIA

⑤	Greek word	Diameter	Structure	Types - Examples
Spherica - Cocci	Kokkos = - grain - Kernel حب النواة	0.5 to 1.25 µm	streptococcus pneumoniae pyogenes • Bunches of grapes • (Aureus) packet arrangement ⊕ Different geometrical ⊗	<ul style="list-style-type: none"> <li>Micrococci → Singly</li> <li>Diplococci → pair-group of 2</li> <li>Streptococci → in chains-row</li> <li>Staphylococci → irregular cluster</li> <li>Tetrads → sequence of four</li> <li>Sarcinae → Cuboidal</li> </ul>
Rod - Bacillus	Bacilli = - rod - stick	0.5-1.2 µ in diameter 3-7 µ in length	<ul style="list-style-type: none"> <li>Ends: - flat</li> <li>- rounded</li> <li>- pointed</li> <li>flagellated</li> <li>- non</li> </ul>	<ul style="list-style-type: none"> <li>Monobacillus → Singly</li> <li>Diplo bacillus → pair-group of 2</li> <li>streptobacillus → in chains-row</li> <li>palisade → Very rarely تراكيب من نوع palisade arrangement</li> </ul>
Coma - Vibrio	-	2.5-1.7 µ in diameter UP to 10 µ in length	<ul style="list-style-type: none"> <li>flagellated (one)</li> </ul>	<ul style="list-style-type: none"> <li>Vibrio Cholerae</li> </ul>
Spiral - Helical	Spira = Coiled	0.5-3 µ in diameter 10-50 µ in length	<ul style="list-style-type: none"> <li>Single spirillum</li> <li>→ has 1-2 Turn</li> <li>flagellated</li> </ul>	البتريا الكوليرية
Spirochaeta	Cork screw - Atrichous	Length > Diameter	<ul style="list-style-type: none"> <li>length Diameter &gt; Spiral</li> <li>3-more turns</li> <li>More flexible</li> </ul>	<ul style="list-style-type: none"> <li>Treponema</li> <li>↓</li> <li>Syphilis الزيف</li> </ul>

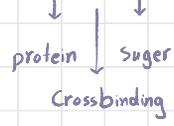
# Structure (cell wall) <sup>Determine</sup> → shape

## Cell envelop



Different from  
archaea + other microbes

Because: It's major component  
is peptidoglycans (sheets)



Thick (+)  
Thin (-)

function & maintain the shape

(+) gram positive  
(-) gram negative

Cell/plasma membrane	Cell wall
(+)                      (-) ②	
○ one or more	○ Just one
○ phospholipid bilayer	○ peptidoglycans
hydrophobic: c <sub>16</sub> lipophilic: c <sub>18</sub>	
②	

- Cell wall → peptidoglycans - lipopolysaccharides (In (-)) → LPS
- Capsule → poly-saccharids, peptides
- plasma membrane → phospholipid bilayer

Anti-biotic causes pl. empty  
 is resistance to this (pl. cell lysis) reason  
 Anti-biotic  
 It has a gene cluster



# External structures



	Location	function	Structure
Capsule	It's a covering layer → around bacterial Cell wall	<ul style="list-style-type: none"> <li>○ provide extra protection against Temporary drying</li> <li>○ By binding water molecules</li> <li>○ Antiphagocytic → Inhibit engulfment of pathogenic bacteria by white blood cells WBC</li> </ul>	<p>A network of</p> <ul style="list-style-type: none"> <li>○ polysaccharides</li> <li>○ polypeptides</li> </ul>
Cell Wall ↓ (+)	<ul style="list-style-type: none"> <li>○ Below external structure</li> <li>○ Above cytoplasmic membrane</li> </ul>	<ul style="list-style-type: none"> <li>○ prevent cell from - expanding - bursting</li> <li>↓ reason</li> <li>↑ water ↓ salt</li> <li>○ Hypotonic environment that the bacteria live in</li> <li>○ provide definite shape</li> </ul>	<ul style="list-style-type: none"> <li>○ Very rigid</li> <li>○ made up of a large number of layers</li> <li>○ The Thickness (+) (-)</li> <li>○ Account 10-40% of the dry weight of bacteria cell</li> </ul>
gram negative (-)		<ul style="list-style-type: none"> <li>○ antigen: protect from hot defenses</li> <li>○ Contribute to (-) charge on Cell surface-Core polysaccharide</li> <li>○ Lipid A: <ul style="list-style-type: none"> <li>- Act as endotoxin</li> <li>- Help stabilize outer membrane</li> </ul> </li> </ul>	<p>O antigen polysaccharide (N=4-40)</p> <p>Core polysaccharide</p> <p>Lipid A</p>

# External structures



Appendages	long	made up of	Structure	Types
<p>flagella</p> <p>Typical →</p>	<p>4-5 <math>\mu</math></p> <p>①</p>	<p>protein flagellin</p>	<ul style="list-style-type: none"> <li>flexible</li> <li>whip</li> <li>singular flagellum</li> <li>Trichous ↓ with Atrichous ↓ lack</li> </ul>	<p>one end</p> <ul style="list-style-type: none"> <li>monotrichous  ①</li> <li>two end</li> <li>Amphitrichous  ②</li> <li>one end <small>صاح الأخرى</small></li> <li>Lophotrichous  ④</li> <li>peri</li> <li>Peritrichous  ③</li> </ul>
<p>fimbria</p>	<p>Short pili</p> <p>③</p>	-	<ul style="list-style-type: none"> <li>Attachment pili</li> </ul>	
<p>Pili</p> <p>↓</p>	<p>smaller than flagella</p> <p>②</p>	<p>protein pilin</p>	<ul style="list-style-type: none"> <li>Hair like</li> <li>single bacteria ↓ Bears 200-500 pili (Peritrichously)</li> </ul>	<ul style="list-style-type: none"> <li>Male Donor (+) factor F<sup>+</sup></li> </ul>
<p>① Sex pili</p>	<ul style="list-style-type: none"> <li>20 <math>\mu</math></li> <li>broad in width</li> </ul>		<ul style="list-style-type: none"> <li>Conjugated</li> <li>Bears 1-10 pili</li> <li>F-pili →</li> </ul>	<ul style="list-style-type: none"> <li>Female Receptor receiver (-) factor F<sup>-</sup></li> </ul>
<p>② Somatic pili</p>	-		<ul style="list-style-type: none"> <li>Attachment</li> <li>Adhesion on surface</li> <li>Bears 100 pili</li> </ul>	

# External structures



Appandages	Location	function
<p>flagella</p> <p>Typical →</p>	<p>Varies in various bacteria</p> <p>Type 2 و 3 و 4 و 5 و 6 و 7 و 8 و 9 و 10 و 11 و 12 و 13 و 14 و 15 و 16 و 17 و 18 و 19 و 20 و 21 و 22 و 23 و 24 و 25 و 26 و 27 و 28 و 29 و 30 و 31 و 32 و 33 و 34 و 35 و 36 و 37 و 38 و 39 و 40 و 41 و 42 و 43 و 44 و 45 و 46 و 47 و 48 و 49 و 50 و 51 و 52 و 53 و 54 و 55 و 56 و 57 و 58 و 59 و 60 و 61 و 62 و 63 و 64 و 65 و 66 و 67 و 68 و 69 و 70 و 71 و 72 و 73 و 74 و 75 و 76 و 77 و 78 و 79 و 80 و 81 و 82 و 83 و 84 و 85 و 86 و 87 و 88 و 89 و 90 و 91 و 92 و 93 و 94 و 95 و 96 و 97 و 98 و 99 و 100</p>	<ul style="list-style-type: none"> <li>○ Motility</li> <li>○ move in a mucus</li> <li>○ for bacteria who lives in <u>water</u></li> </ul> <p>Ex → Colera is flagellated</p>
<p>fimbria</p>	<ul style="list-style-type: none"> <li>○ At the poles of a cell</li> <li>○ Spread over it's entire surface</li> </ul>	<p>To attach the bacterium to a Surface</p>
<p>Pili</p> <p>↓</p>	<p>on the surface of the most gram negative bacteria</p>	<p>No role in the motility</p>
<p>① Sex pili</p>  <p>as a Duct</p>		<p>Recognize the receptor protein on the surface of female or recipient</p>
<p>② Somatic pili</p>		<p>help the bacterium to attachment to a Substratum</p>

# History of cell wall



- Danish scientist : Hans christian Gram : 1884

The way →

- Searching for a method that would allow visualtion of bacteria in tissue of lungs for who deid from pneumonia

↓  
Streptococcus  
pneumonia

↓  
Retained the stain  
(+) gram

After washing  
with Alcohol

↓  
Klebsiella  
pneumonia

↓  
Didn't retain the stain  
(-) gram

- German pathologist : Carl weight : 1885 - 1904

→ Discover a stain to retained bacteria that is (-) gram

Lipopolysaccharide  
⊙ outer membrane  
M Negative  
G gram?



P Positive  
Peptidoglycan (thick)  
T Teichoic acid



□ pathogenic of LPS :

Lipid A : Cause uncontrolled activation of mammalian immune system  
production inflammatory mediators

Lead to → Septic shock

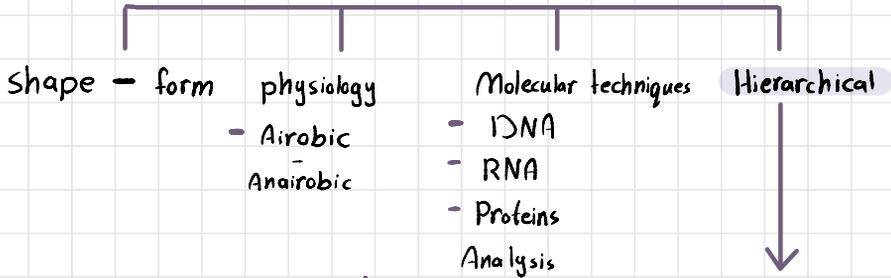
# Internal structures



= Inclusion bodies

- Organic material
- Inorganic material
- Stocked for future use
- Some are inclosed by Singlelayered membrane  $\xrightarrow{\text{made of}}$  lipids proteins

## Classification of bacteria



### Taxonomic classification

- Binomial (scientific) nomenclature
- Each microbe 2 names :-
  - Genus → Capitalized
  - Species → lowercase
- ↳ 130th
- Italicized
- Underlined

Formal rank	Example
Kingdom	Prokaryotae
Division	Gracillicutes
Class	Scotobacteria <small>جراثيم في البروتوبلاست</small>
Order	Eubacteriales
Family	Enterobacteriaceae
Genus <small>نوع واحد</small>	<i>Escherichia</i>
Species <small>أكثر من نوع</small>	<i>Coli</i>

A group of isolates - strains

Kind > 20  
In stomach

- *Staphylococcus aureus* (*S. aureus*)
- *Bacillus subtilis* (*B. subtilis*)
- *Escherichia coli* (*E. coli*)