بسم الله الرحمن الرحيم

362 micro

Lab 4 : Bacterial Appendages (2)

Structures

1

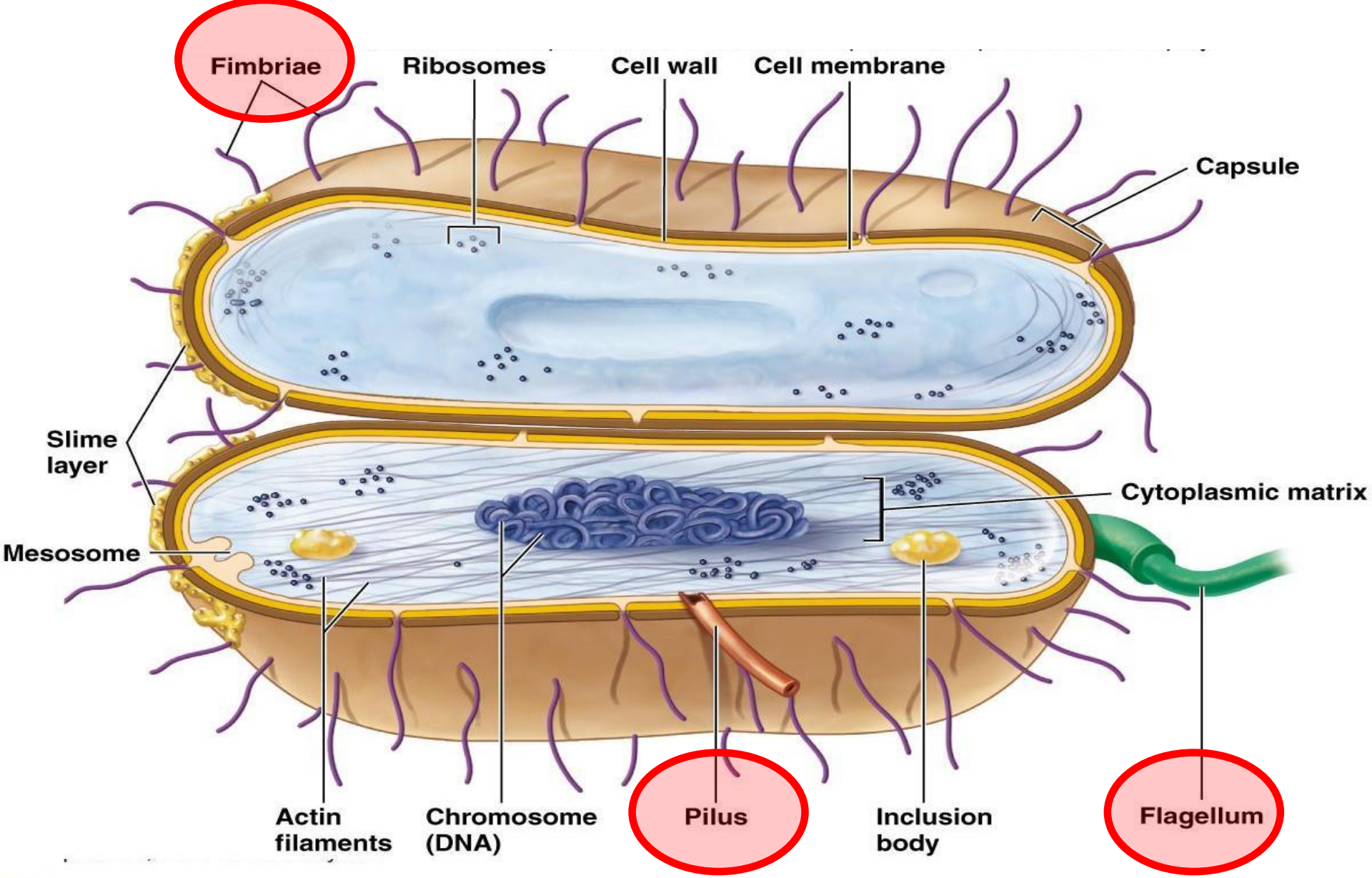
Capsule

2

-Pili
-Fimbriae
-Flagella

3

Endospores

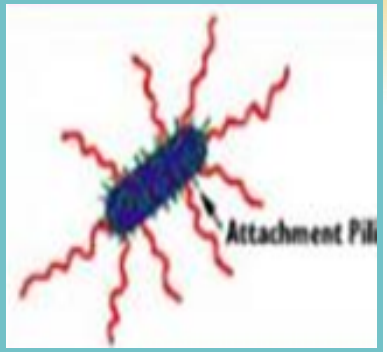


5 Cells secrete their enzymes in unison to digest food particles.

Bacterial Appendages

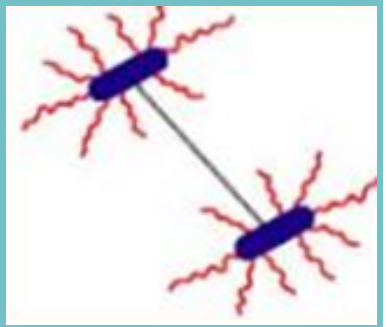
Pili

Pili , (pilus)

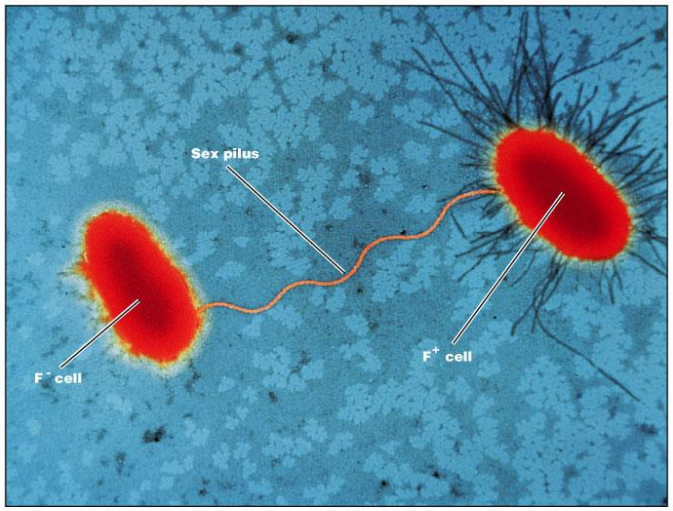


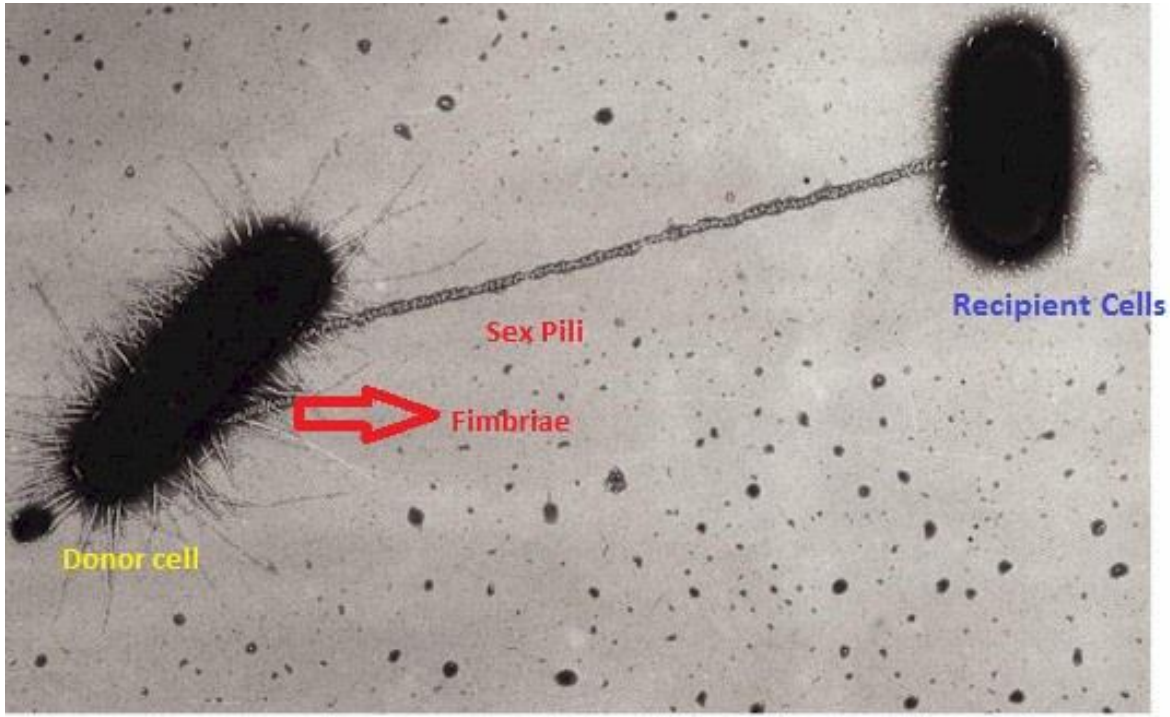
- Only found in **gram negative** bacteria
- Tubulare, hairlike structures of protein larger and more rare than fimbriae.

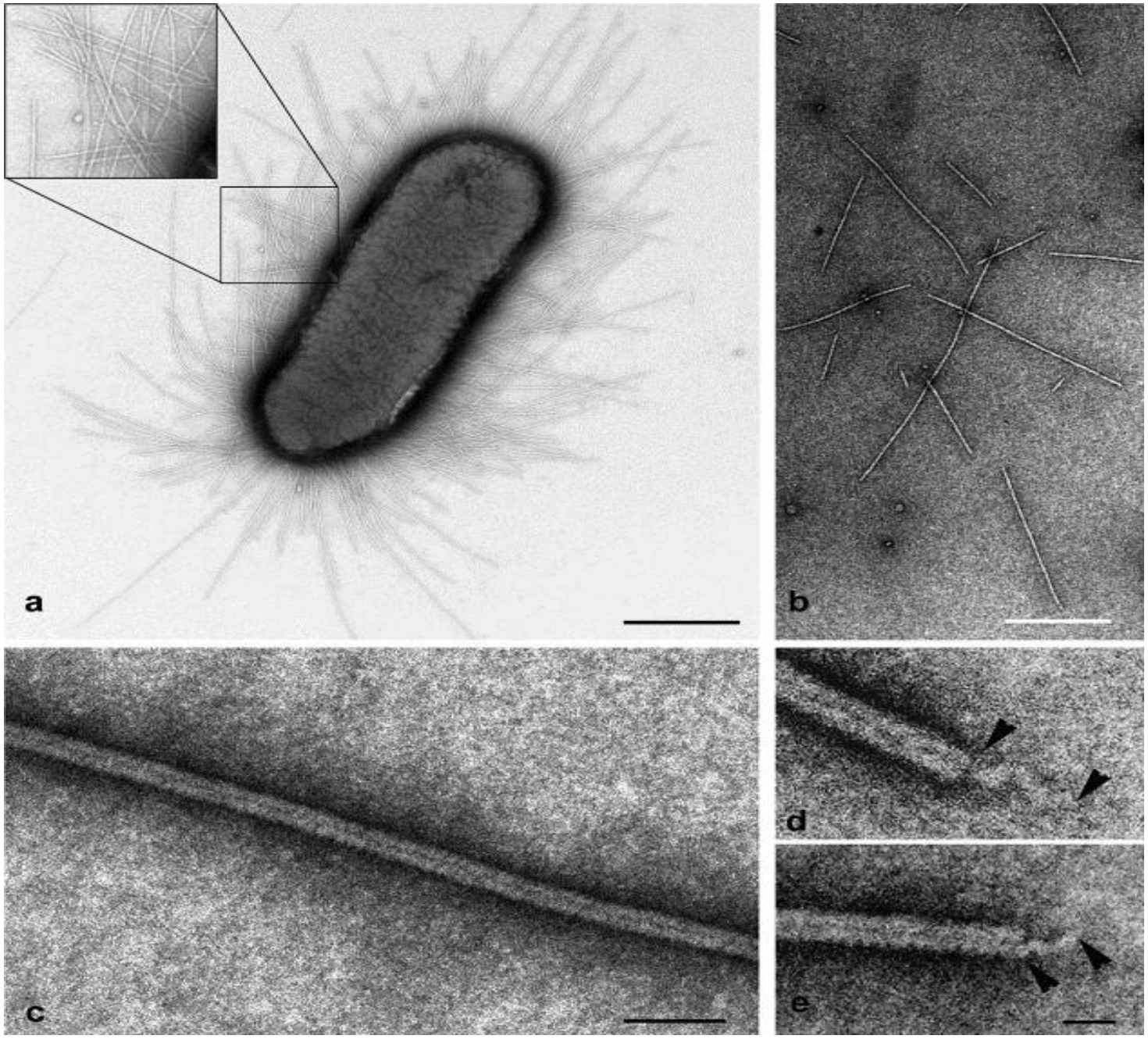
2 types of pili :



1. **Atachement pilus** - allow bacteria to attach to other cells
2. **Sex pilus**, - transfer from one bacterial cell to another, only 1-4 , conjugation.





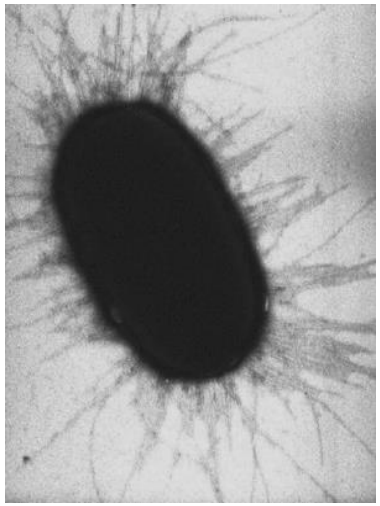

a
b
c
d
e

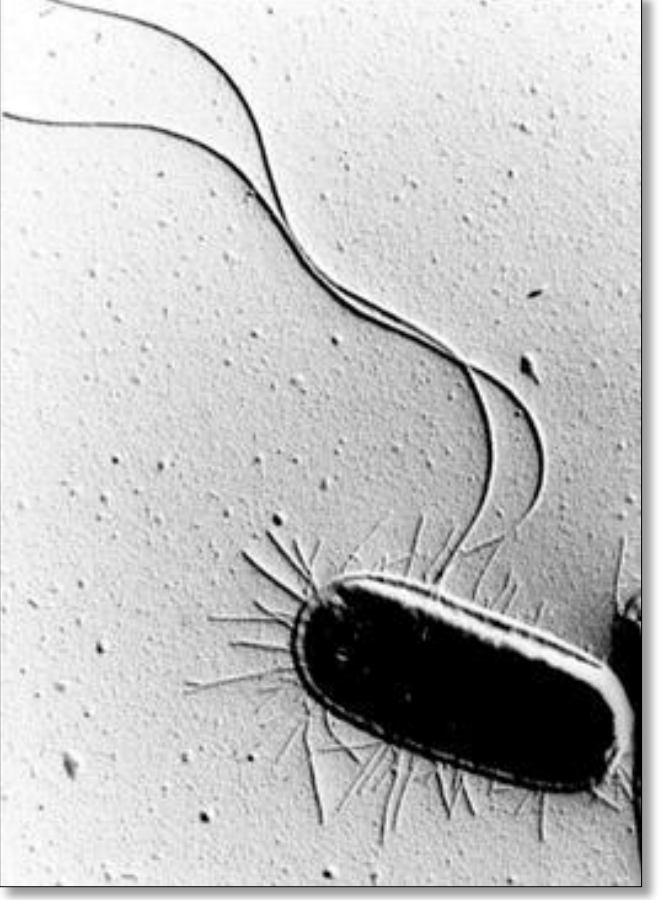
Bacterial Appendages

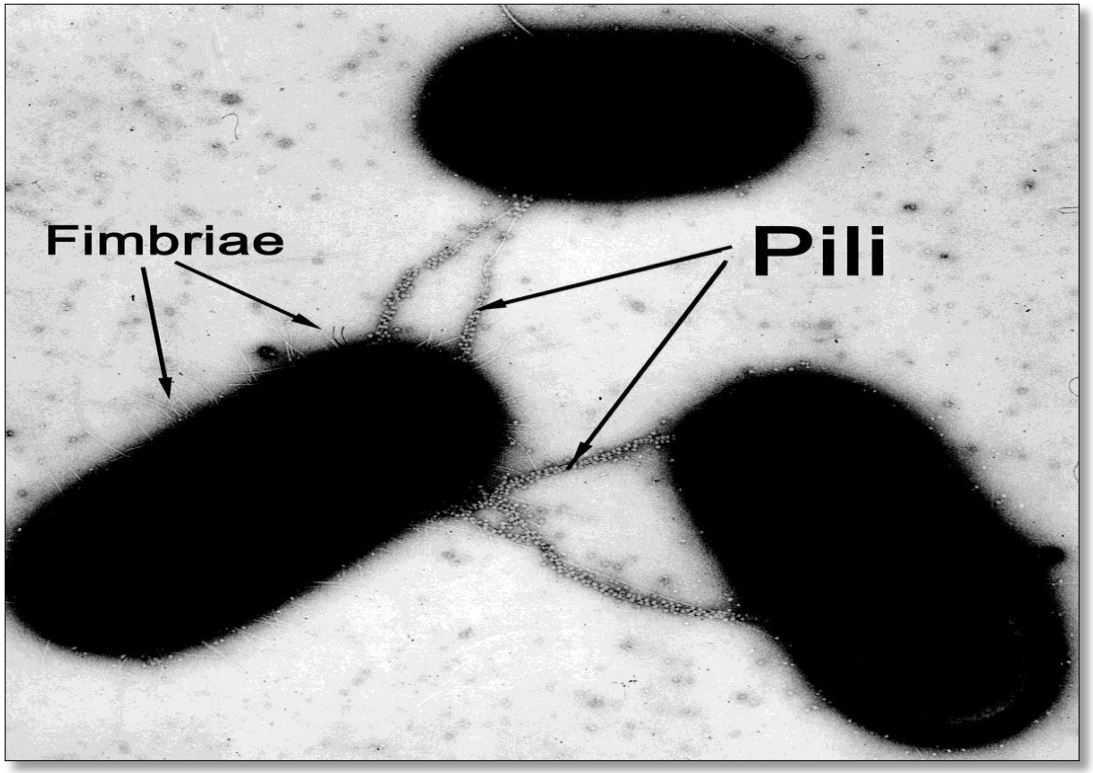
Fimbriae

Fimbriae

- Fimbriae are very fine fibrillar structures.
  - Fimbriae help the bacteria to stick to surfaces.
  - e.g. *E.coli*






Fimbriae
Pili

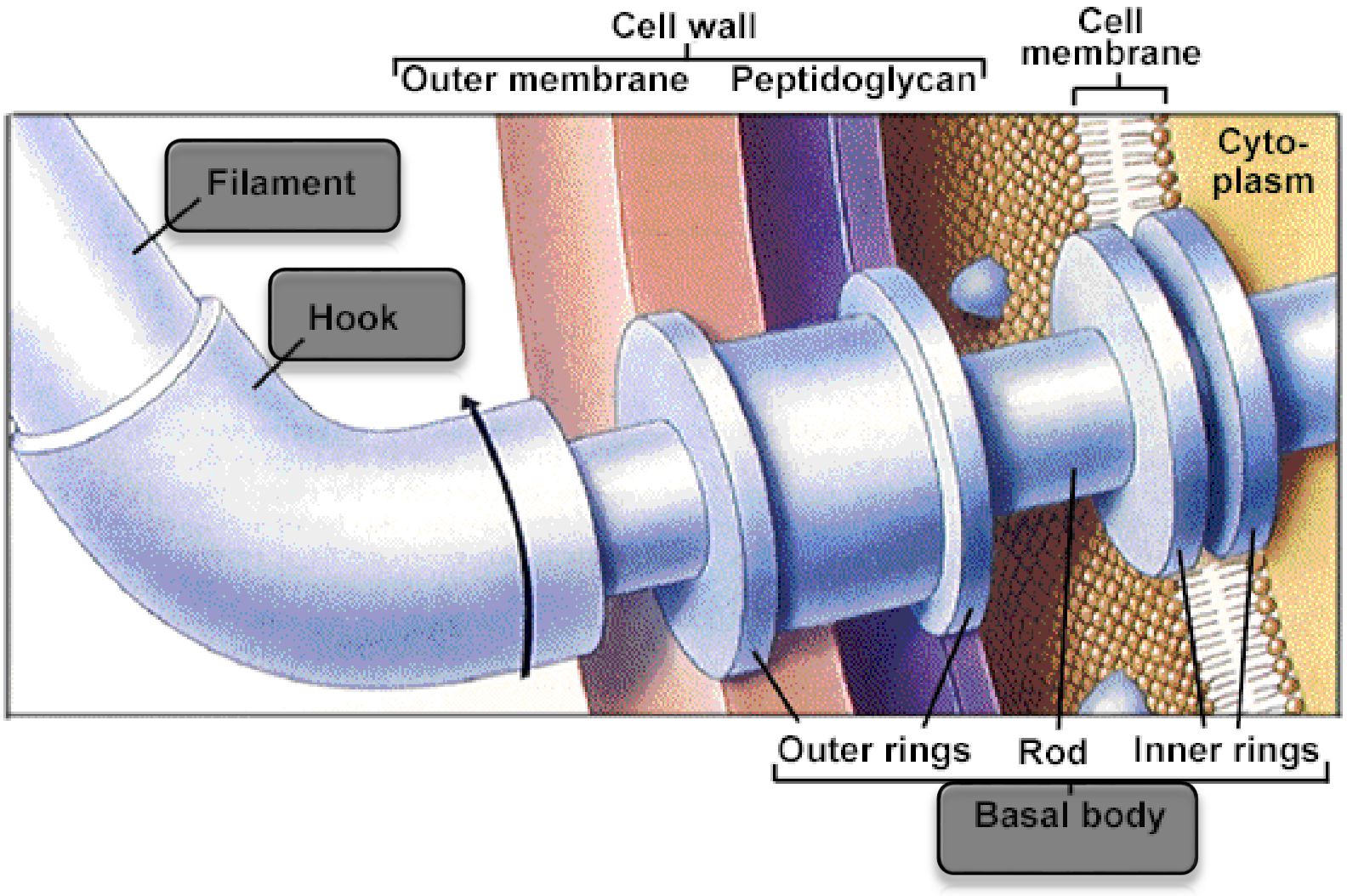
Bacterial Appendages

Flagella

Flagella

- **Flagella :**
  - long appendages which rotate by means of a "motor" located just under the cytoplasmic membrane.
  - bacteria may have one, a few, or many flagella in different positions on the cell.
- **Advantages:**
- Identification of Bacteria
- Pathogenesis
- Motility of bacteria
- **All spirilla, half of bacilli, rare cocci.**

Structure of flagella

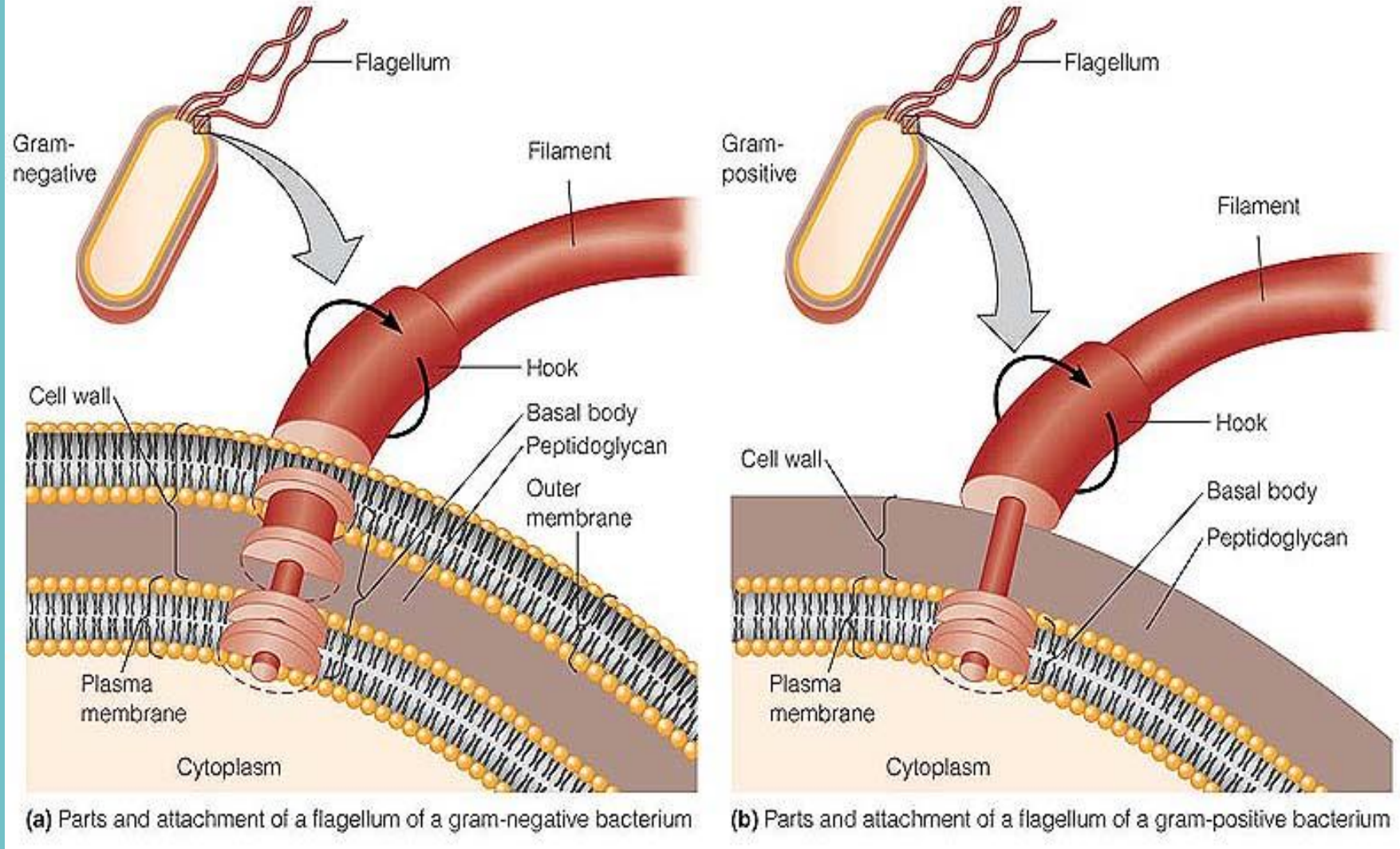

Cell wall
Outer membrane
Peptidoglycan
Cell membrane
Cyto-plasm
Filament
Hook
Outer rings
Rod
Inner rings
Basal body

Structure of flagella

Three morphological regions :

1. **Helical filament**
   - contains the protein (flagellin) arranged in several chains.
2. **Hooked or curved area**
   - Consists of a different protein.
3. **Basal body**
   - Terminal portion of the flagellum
   - Fix the flagellum to the cell wall and plasma membrane
   - Composed of a central rod inserted into a series of rings

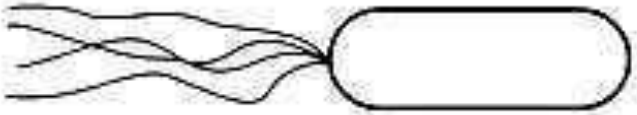
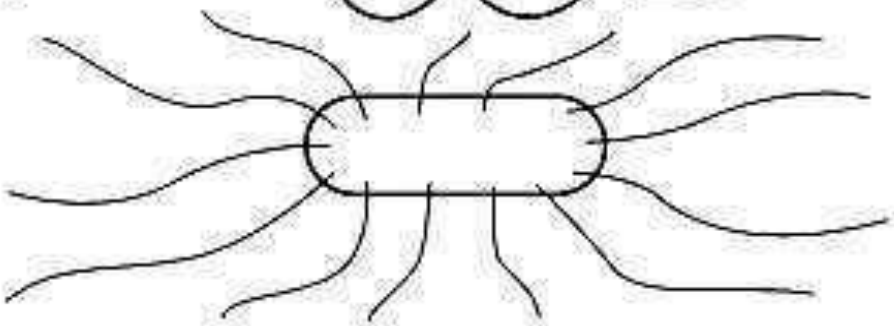
Flagella in gram negative and positive bacteria



Flagella in gram negative and positive bacteria

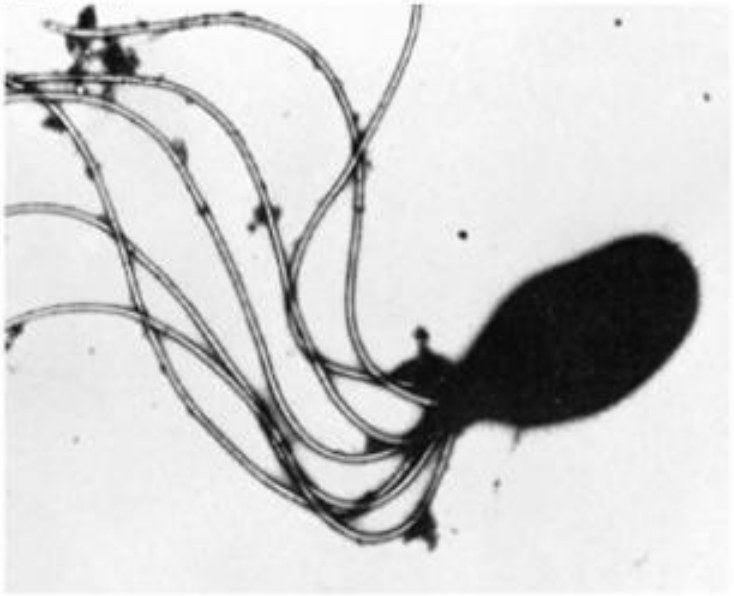
- **Gram negative - 2 pairs of rings :**
  - **Outer pair** - fixed to the outer membrane and peptidoglycan layer
  - **Inner pair** - fixed to the plasma membrane
- **Gram positive - only inner pair is present**

Arrangement

Structure	Flagella Type	Example
	Monotrichous	*Vibrio cholerae*
	Lophotrichous	*Bartonella bacilliformis*
	Amphitrichous	*Spirillum serpens*
	Peritrichous	*Escherichia coli*

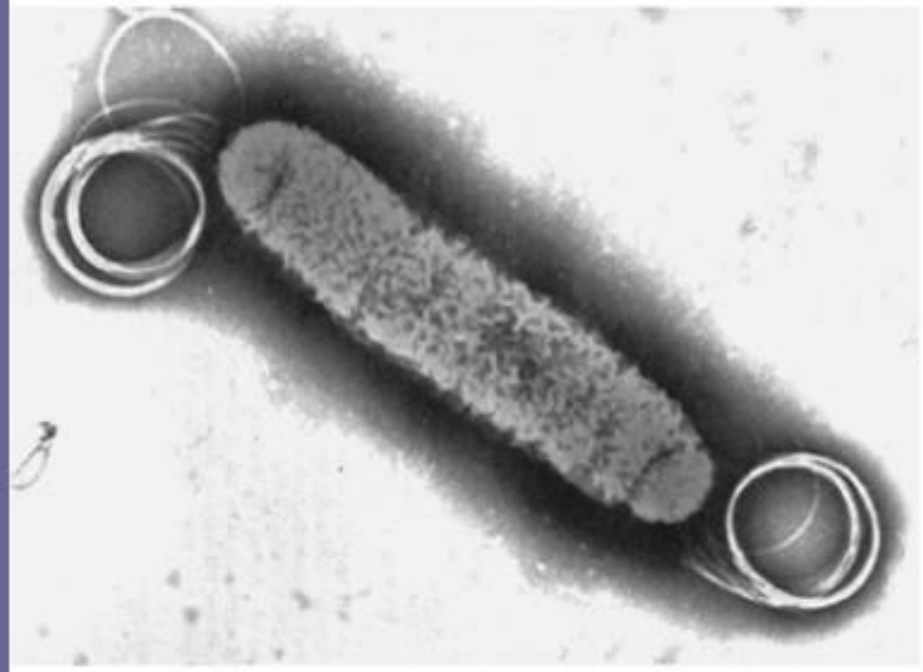
(a)

© Dr. Jeffrey C. Burnham



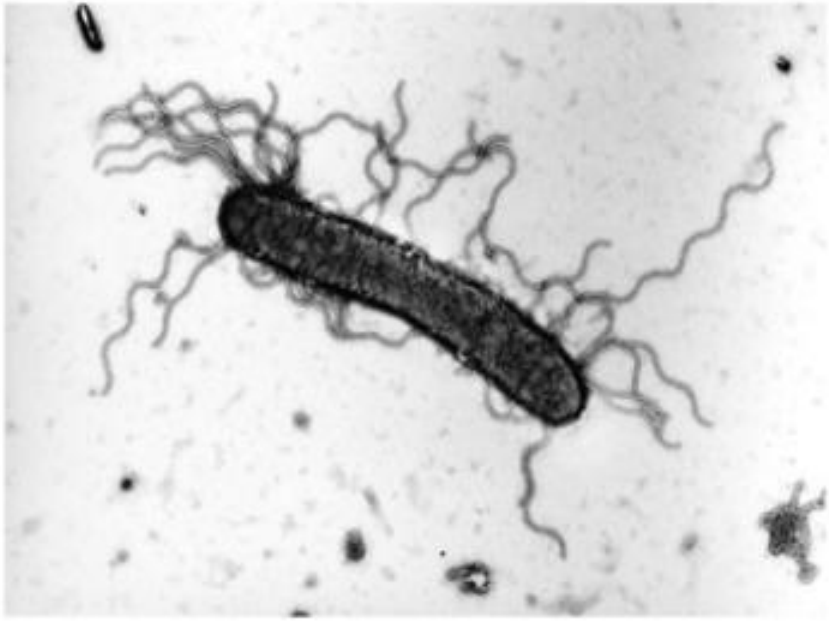
(b)

© From Reichelt and Baumann, Arch. Microbiol. 94:283-330. © Springer-Verlag, 1973



(c)

© From Noel R. Krieg in Bacteriological Reviews, March 1976, Vol. 40(1):87 fig. 7

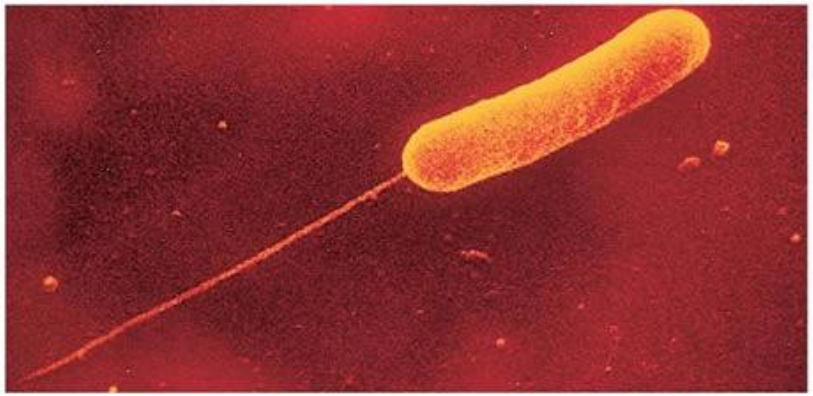


(d)

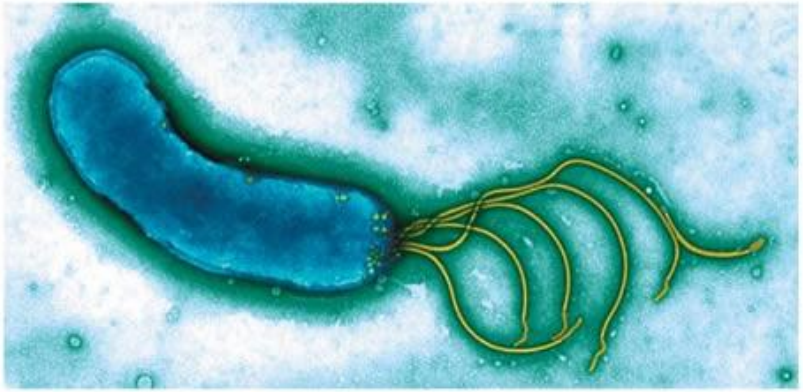
© From Preer et al., Bacteriological Review, June 1974, 38(2), 131, fig.7 © ASM

Arrangement

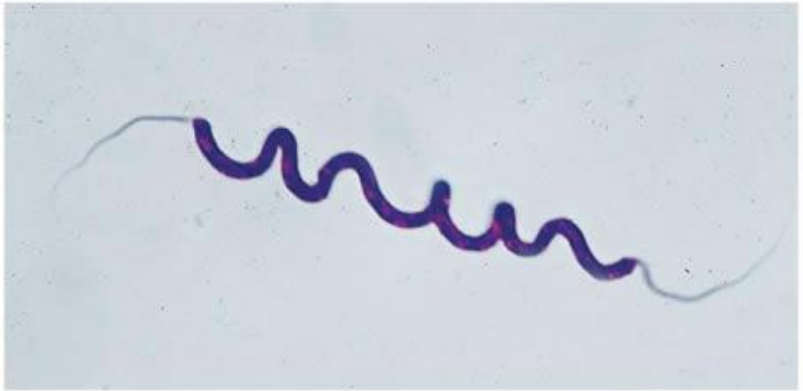
(a) Peritrichous SEM 0.5 μm



(b) Monotrichous and polar SEM 0.5 μm



(c) Lophotrichous and polar SEM 0.5 μm



(d) Amphitrichous and polar SEM 5 μm

Motility

Evidence of motility

Two ways by which motility can be demonstrated:

1- direct or microscopic

- **hanging drop** preparation by dark field microscope

Distinguishes:

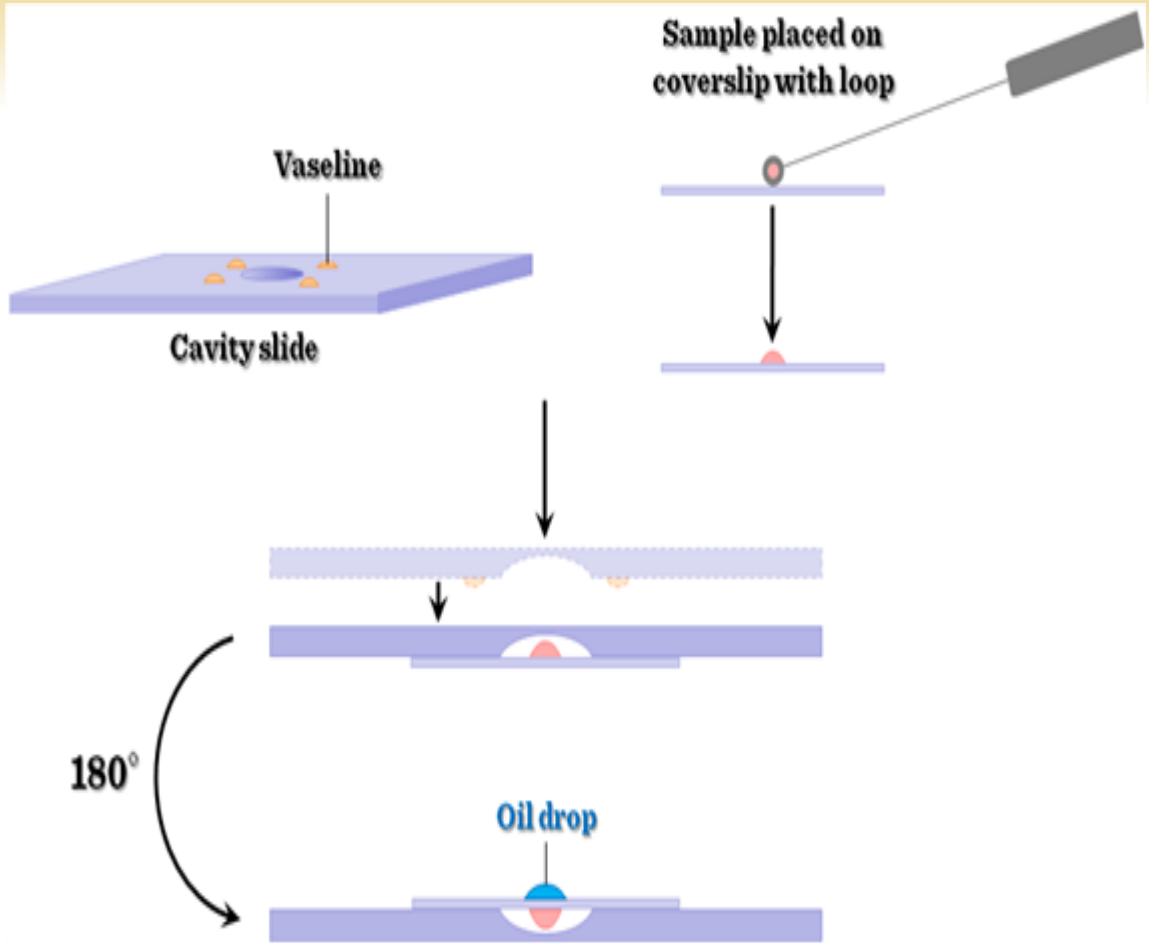
- **Brownian movement -** when the bacteria show molecular movement
- **True motility -** if a bacterium describes a rotatory, undulatory or sinuous movement

2- indirect or macroscopic :

Stab inoculation of the semisolid media

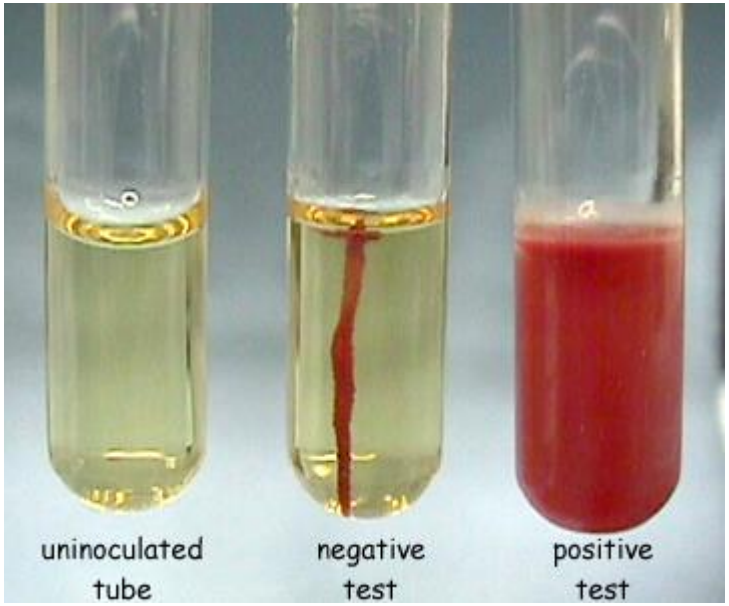
- **non motile -** growth is limited at the point of inoculation
- **motile -** growth is diffuse or moves away from the line of inoculation; turbidity of the medium

- Direct

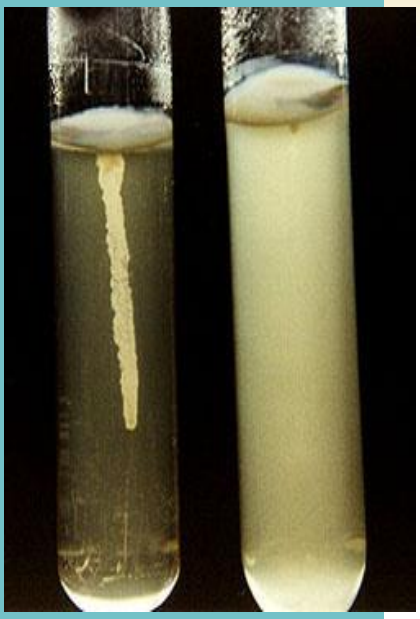

Sample placed on
coverslip with loop
Vaseline
Cavity slide
180°
Oil drop

Motility test medium

- Indirect

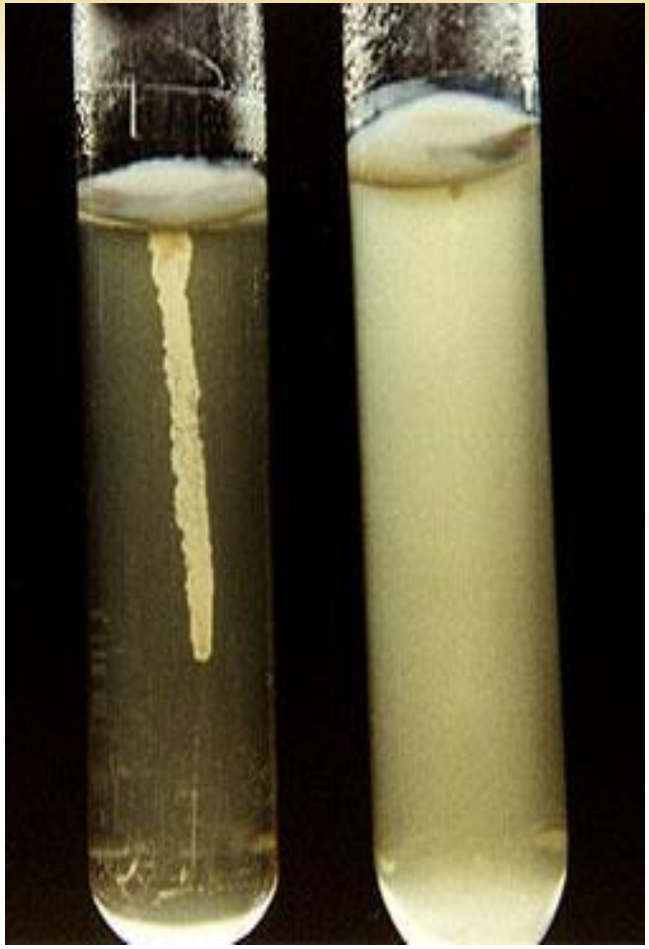


Motility test medium



- Bacterial cells can swim in a semisolid medium.
- A semisolid medium such as O.75% agar is inoculated with the bacteria in a straight-line stab with a needle.
- After incubation, if turbidity (cloudiness) due to bacterial growth can be observed away from the line of the stab.

Bacterial cultures grown in motility test medium. The tube on left is a non motile organism; the tube on right is a motile organism.



non motile organism

motile organism

Bacterial Motility Test