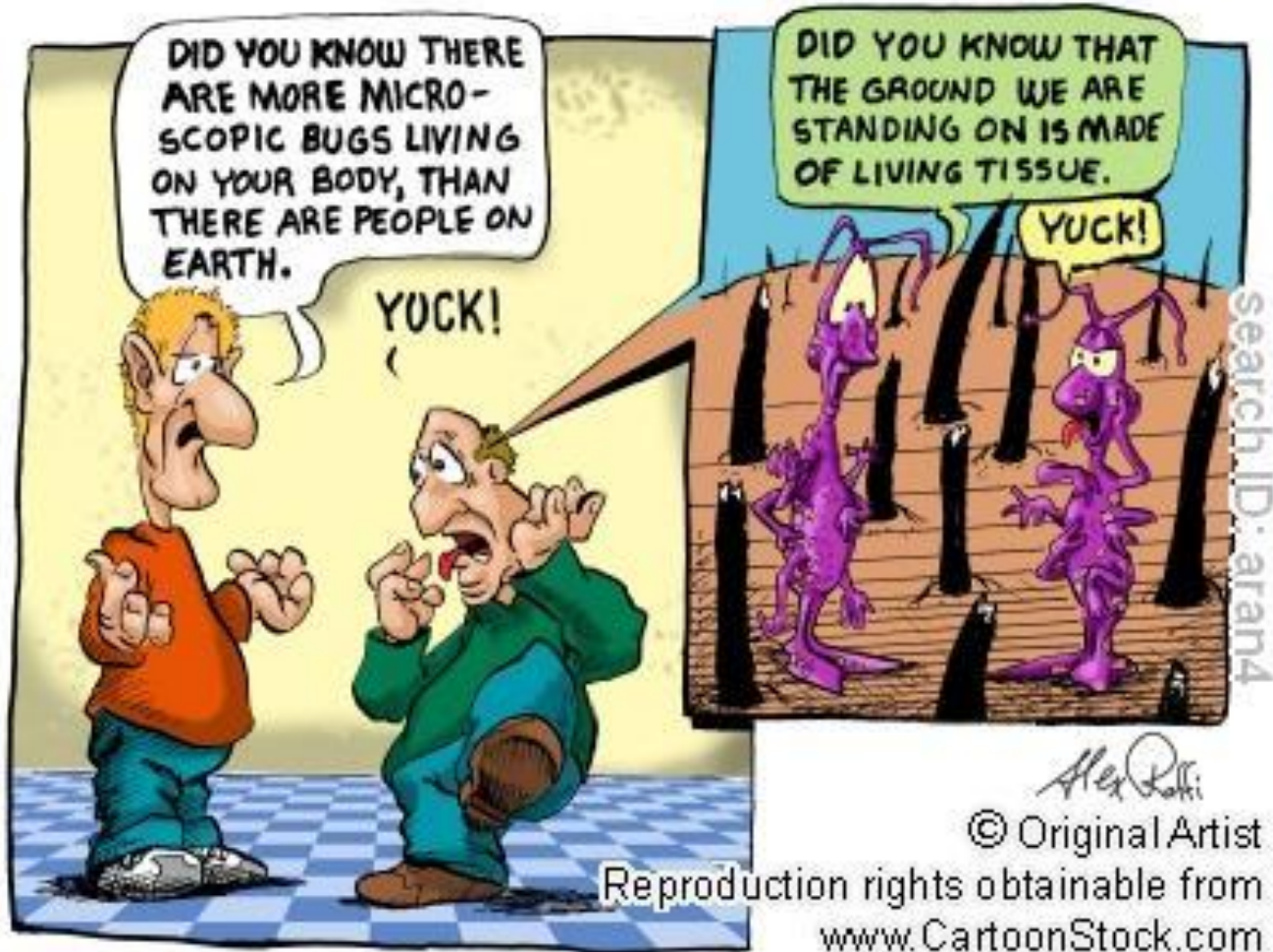


1

# Bakteri Hücresinin Yapısı

Dr.Füsün Can



# Objektifler

3

- Bu ders sonrasında öğreneceğiniz:
  - Ökaryot ve prokaryot hücre farkı
  - Bakteri hücresinin komponentleri ve fonksiyonları
  - Bakteri hücresinin bölünmesi
  - Bakteri hücresinin metabolizması

# Bakteri Hücre Yapısı

Hücre duvarı

Cell Membranı

Sitoplazma

Kapsül

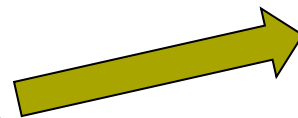
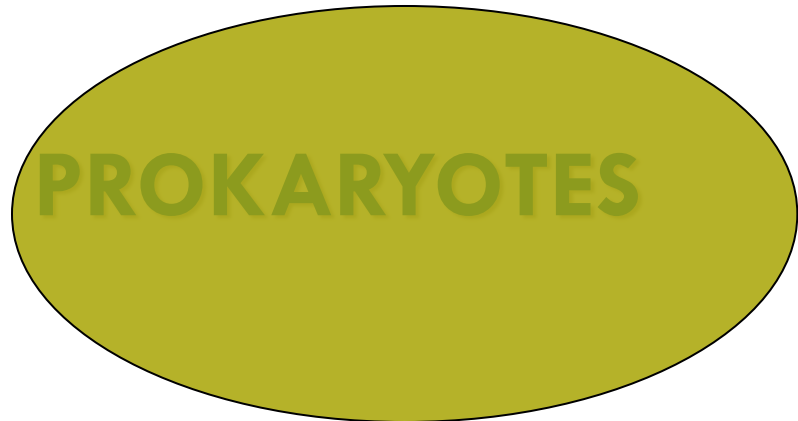
Flajella

Fimbria

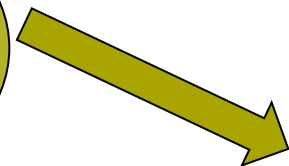
Spor

# Hücre

5



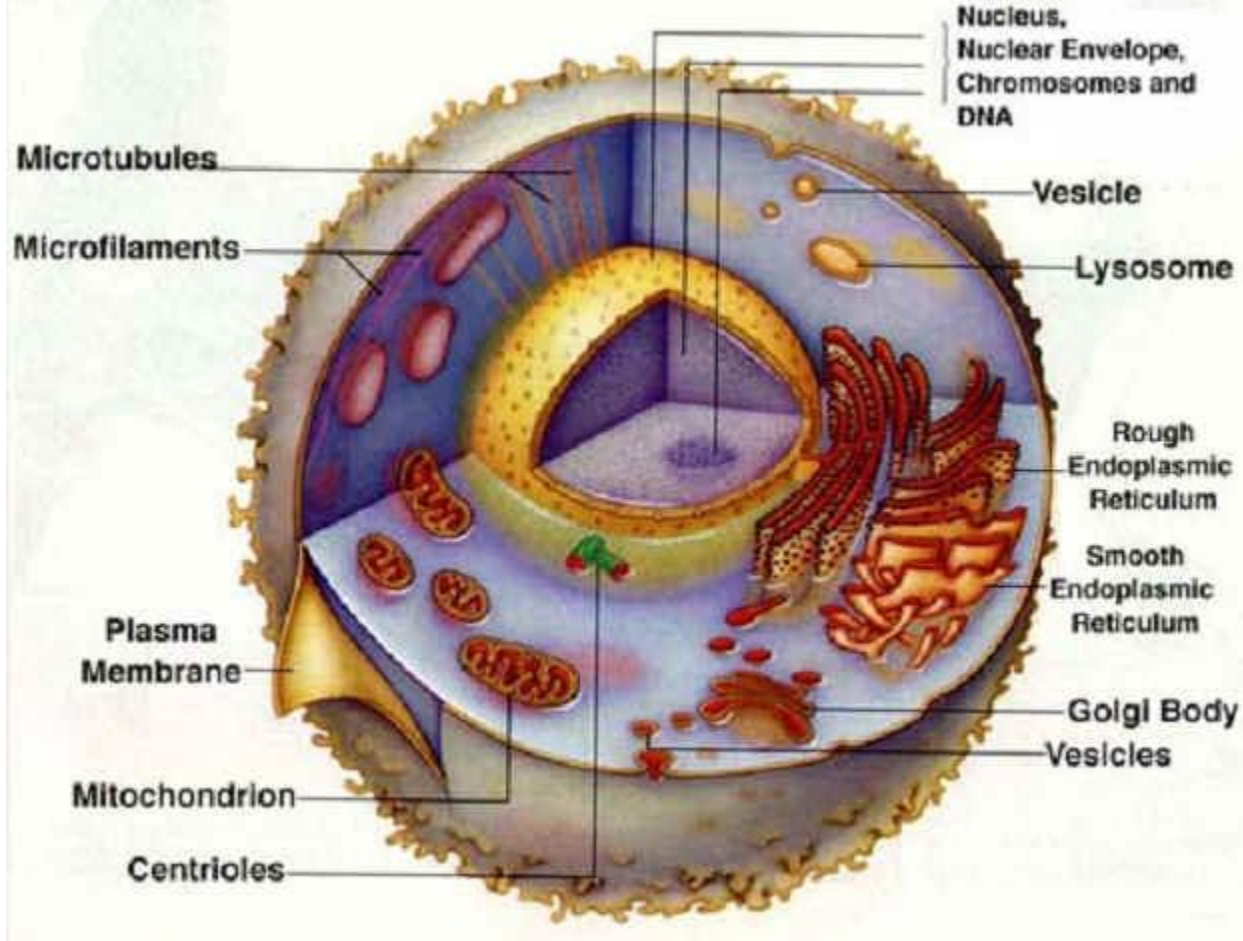
BACTERIA



ARCHAEA

# Ökaryotlar(gerçek nükleus)

6



□ Hayvan, bitki, mantar

# Prokaryotlar (*primitif n kleus*)

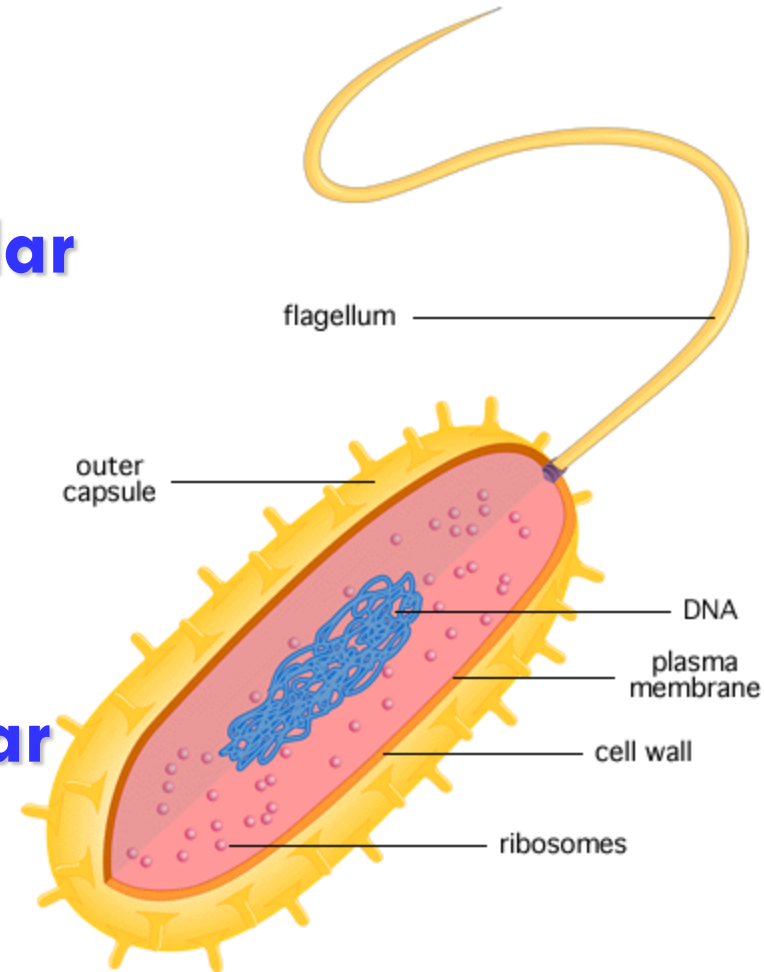
7

## □ Bakteriler

- Patojenik mikroorganizmalar
- yaklaşık  apı .1  m
- 

## □ Archaea

-  evresel mikroorganizmalar



Characteristic	Eukaryote	Prokaryote
Size	>5 $\mu\text{m}$	0.5 to 3 $\mu\text{m}$
<b>Nuclear structures</b>		
Nucleus	Classic membrane	No nuclear membrane
Chromosomes	Strands of DNA	Single, circular DNA
	Diploid genome	Haploid genome
<b>Cytoplasmic structures</b>		
Mitochondria	Present	Absent
Golgi bodies	Present	Absent
Endoplasmic reticulum	Present	Absent
Ribosomes	<b>80 S (60+40)</b>	<b>70 S (50+30)</b>
Cytoplasmic membrane	Contains sterols	Does not contain sterols
Cell wall	<b>Absent /composed of chitin</b>	<b>Complex structure</b>
Reproduction	Sexual or asexual	Binary fusion
Movement	Complex flagellum	Simple flagellum
Respiration	Via mitochondria	Via cytoplasmic membrane



# Prokaryotik hücre vs Ökaryotik Hücre

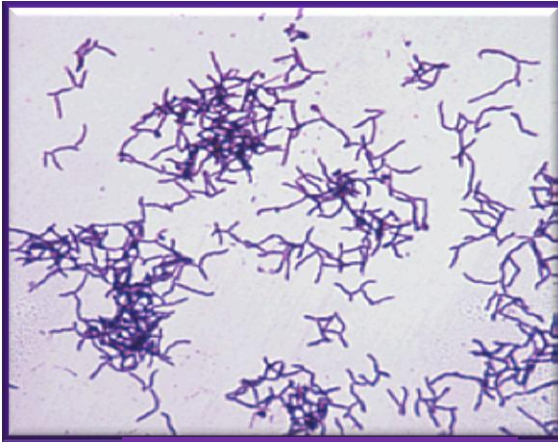
9

- Bakteriler
  - Düşük osmotik basınç
  - Farklı ısılar
  - Kuruluk
  - Çok kısıtlı enerji kaynaklarında

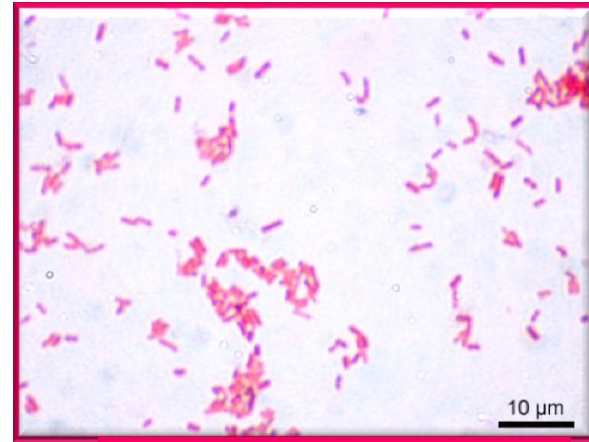
Yaşayabilir ve üreyebilirler

# Gram Boyama

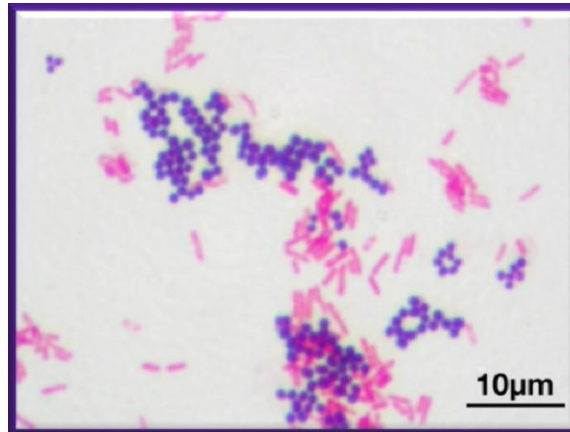
10



**Gram positif**



**Gram negatif**



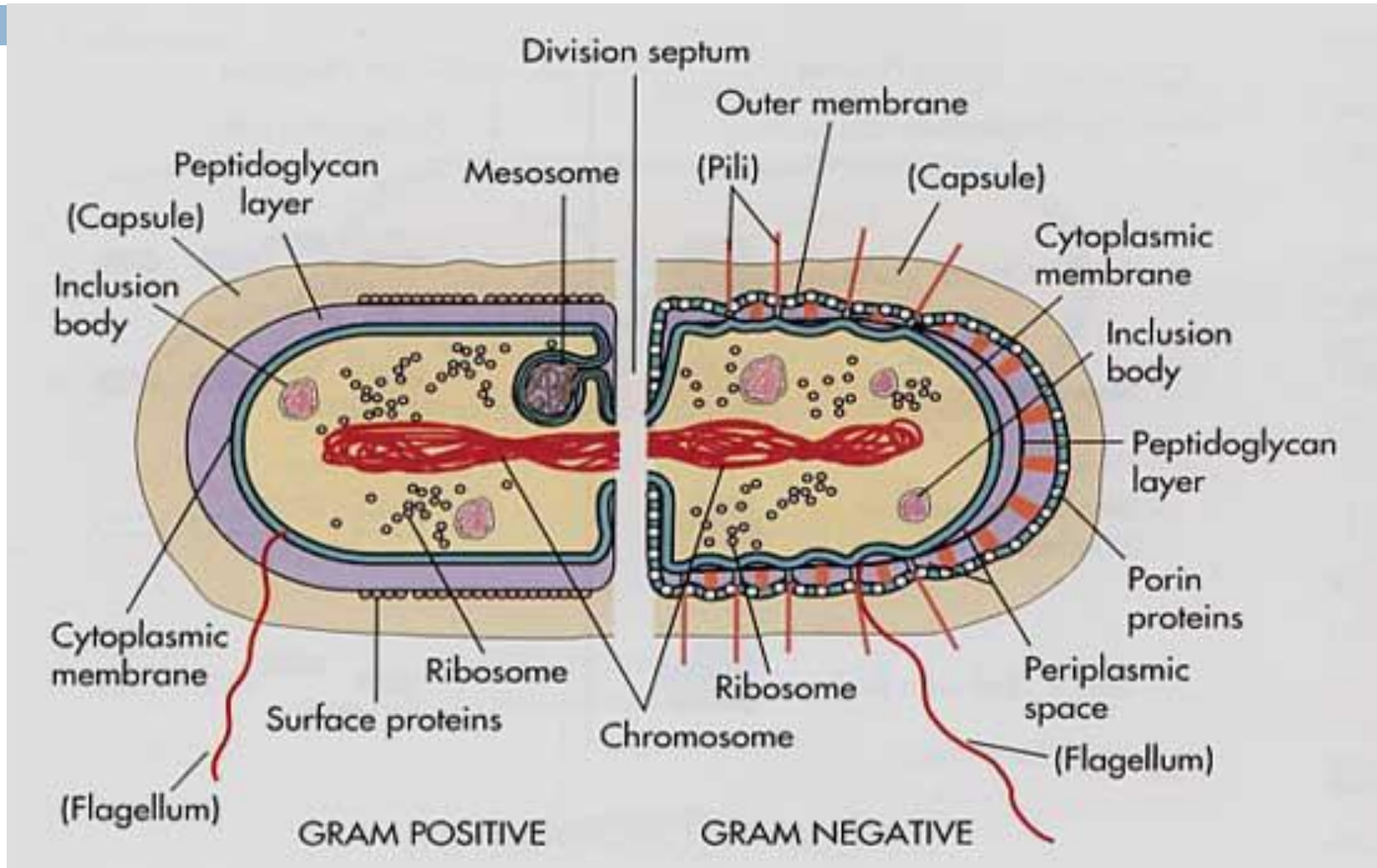
11

# NEDEN BU HÜCRELER FARKLI RENKLERDE BOYANMIŞLAR?

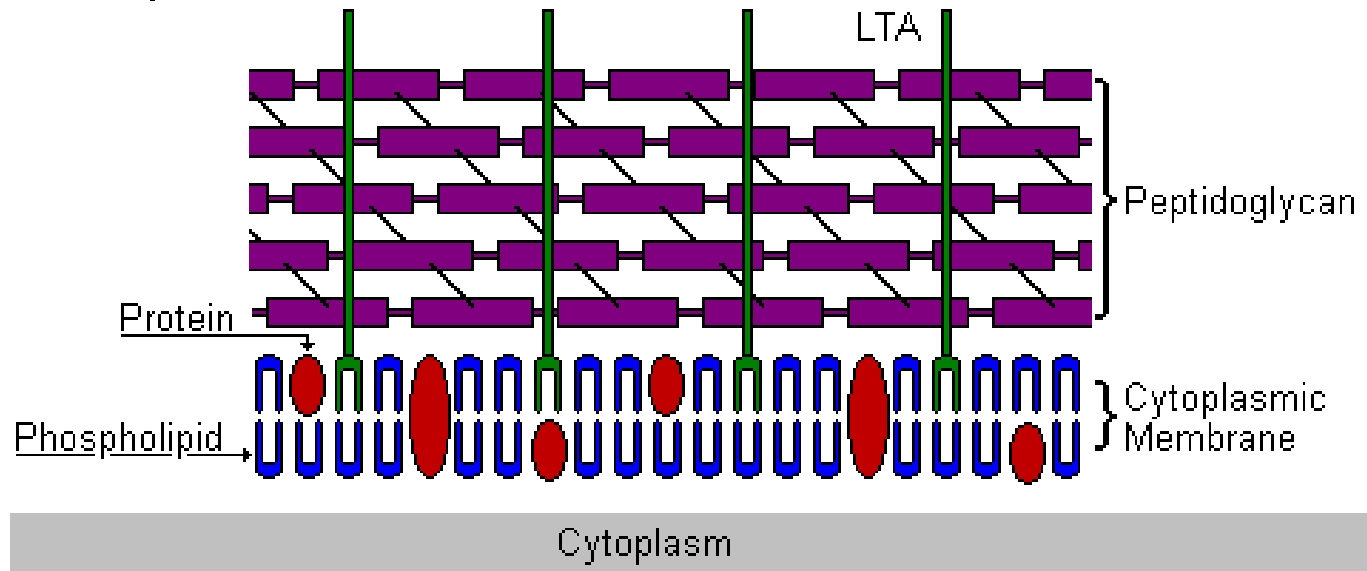
Hücre Duvar Yapılar Farklı

# Bacteri Hücresi

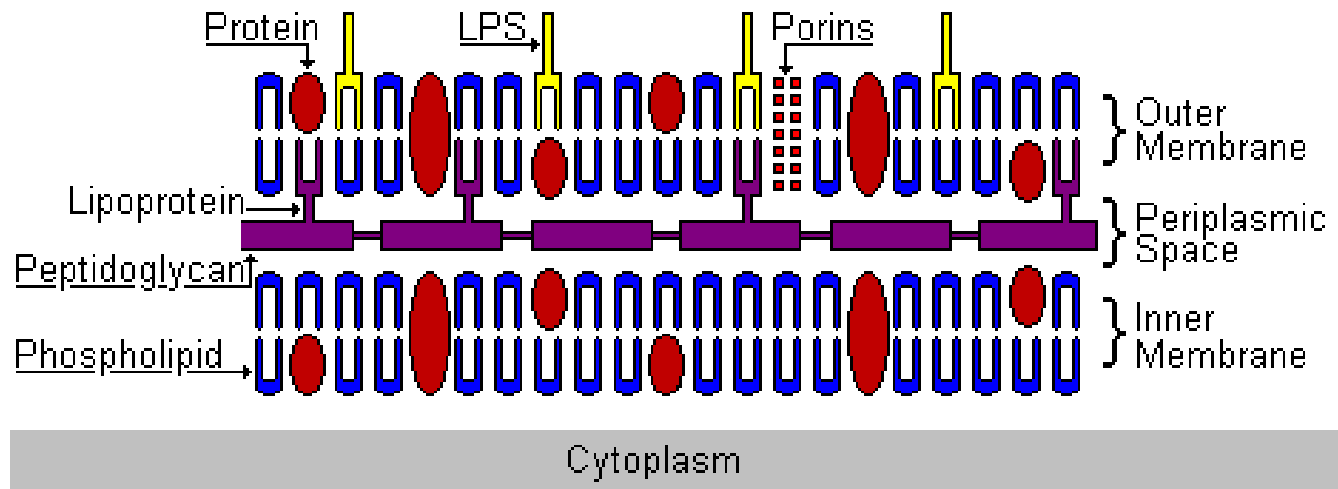
12



## *Gram-positive Cell Wall*



## *Gram-negative Cell Wall*



# Bakteri Hücre Duvarı Yapısı

## Gram-pozitif bakteriler

Peptidoglikan	GlcNAc ve MurNAc glikan zincirleri birbirlerine peptid köprüleri ile bağlanır
---------------	---

Teichoic acid

Lipoteichoic acid	Teichoic acid lipid ile bağlanır
-------------------	----------------------------------

## Gram-negatif bakteriler

Peptidoglikan	Gram pozitiflerden daha ince
---------------	------------------------------

Periplazmik aralık	Transport, degradasyon ve sentez enzimleri bulunur
--------------------	--

Outer membran	Fosfolipidler
---------------	---------------

Protein	Porinler, lipoprotein, transport proteinleri
---------	--

LPS	Lipid A, kor polisakkaridi, O antijeni
-----	--

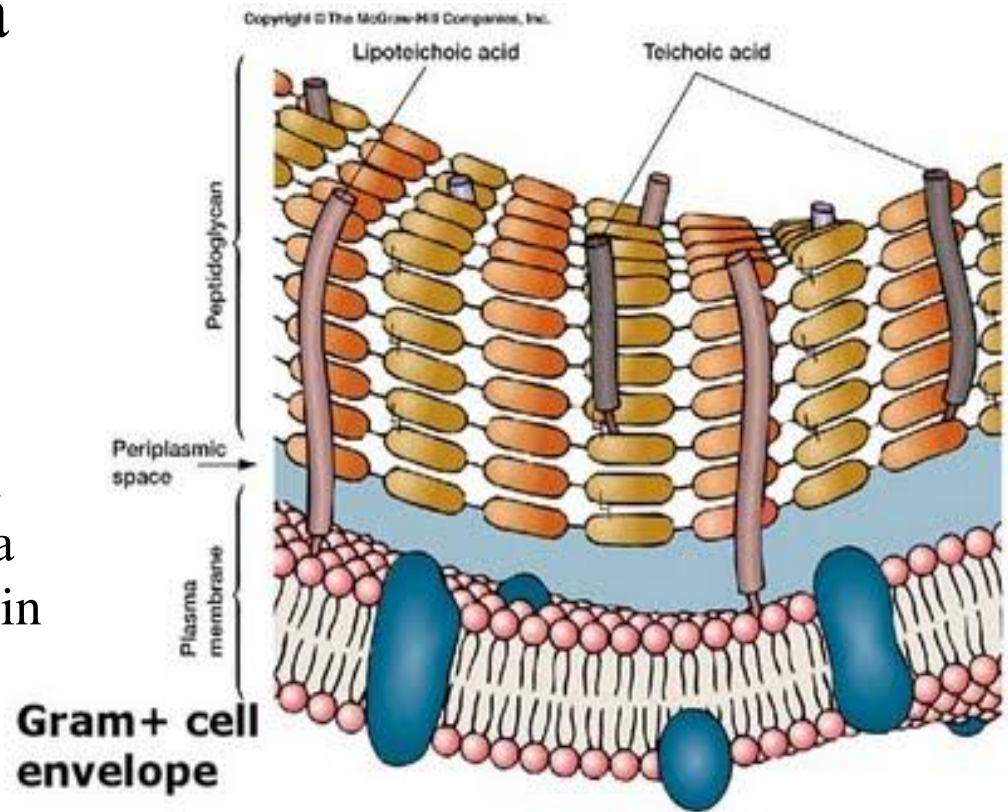
# Gram Pozitif Hücre Duvarı

15

- Kalın peptidoglikan tabaka
- Pirojenik

Teichoic acid  
Lipoteichoic acids

Antijenik  
Bağlanma  
Endotoksin



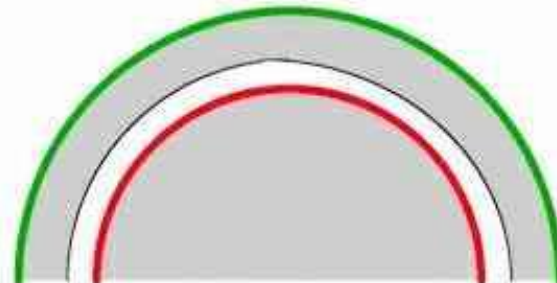
# Gram positif vs Gram negatif

16

Gram positive



Gram negative



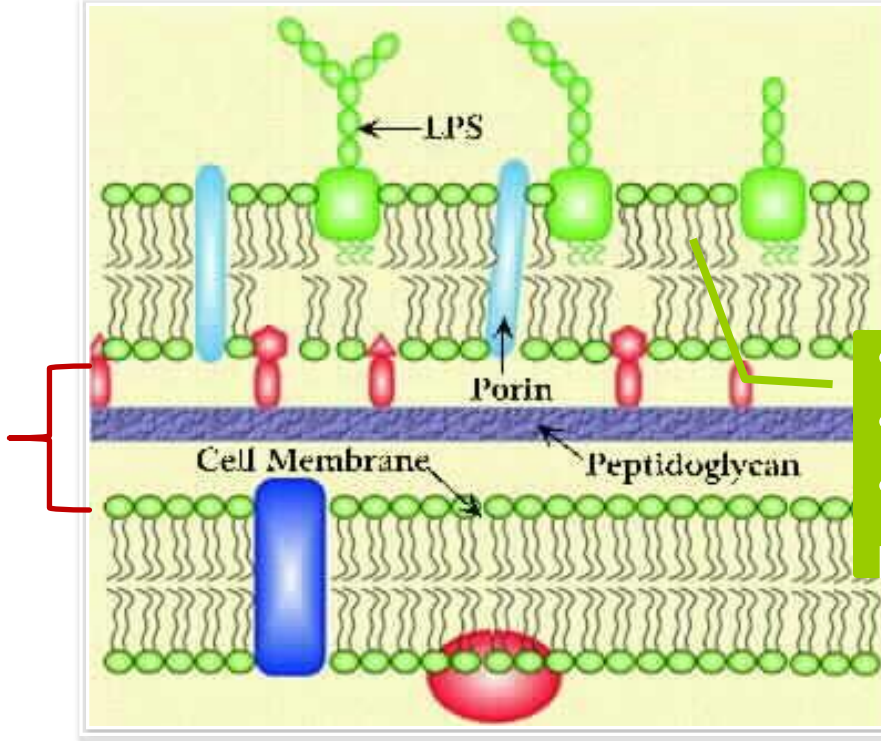
Red: cell membrane  
Black: peptidoglycan  
Green: Outer membrane



# Gram Negatif Hücre Duvarı

17

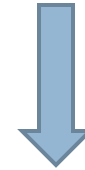
**Periplazmik aralık**  
Enzimleri ve Büyük moleküller  
depolanır  
Metabolitler için transport  
sistemleri bulunur



**İki tabakas:**

- İnce peptidoglikan tabaka
- Dış membran

- Gram negatiflere özel
- Asimetrik bilayer
- Büyük moleküllere permeabilite bariyeri



Lipopolisakkarit (LPS)  
Porin ve proteinler

# Lipopolisakkarit

18

Üç yapısal bölgeden oluşur:

## Lipid A

- Benzer veya aynı
- Endotoxin



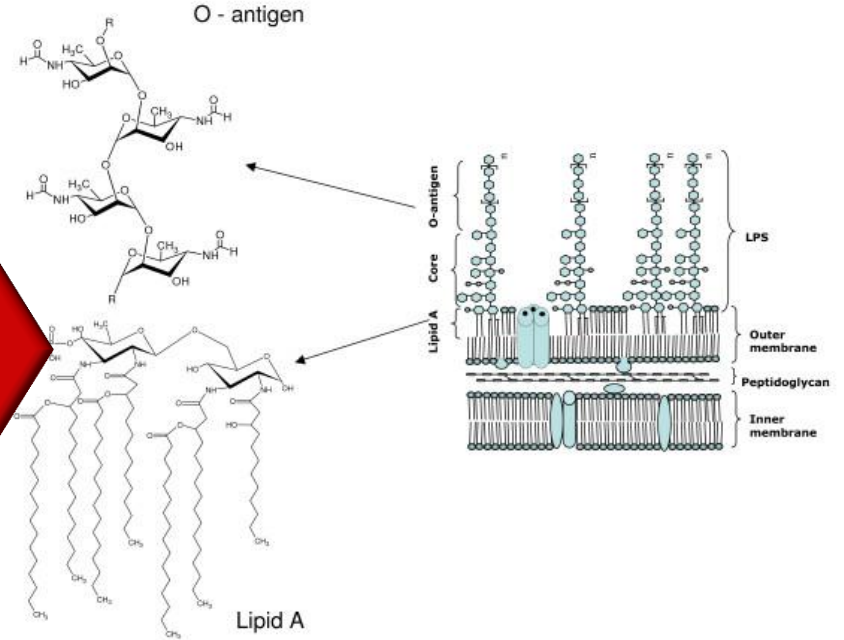
## Kor polisakkarit

- Değişken
- Türler



## O antijen

- Çok değişken
- serotip



# Dış Membranın Görevleri

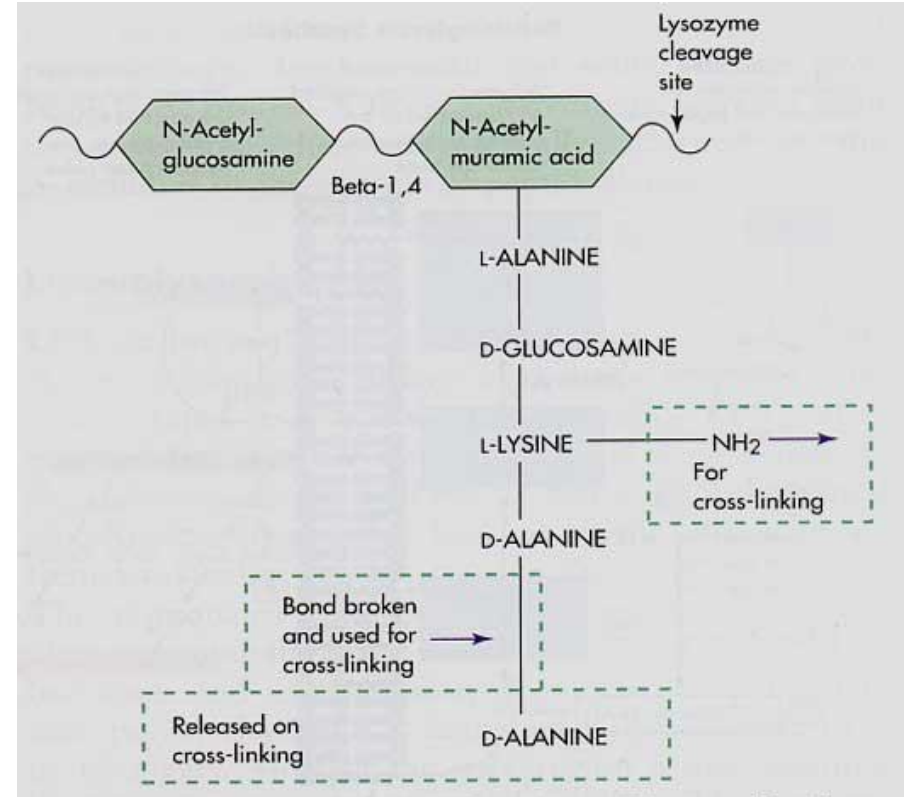
19

- ▣ *Bakterinin yapısını korur*
- ▣ *Büyük moleküllere geçirgenlik bariyeri*
- ▣ Zor çevre şartlarına karşı korunmada etkindir.  
(Örn. Konak GİS)

# Peptidoglycan

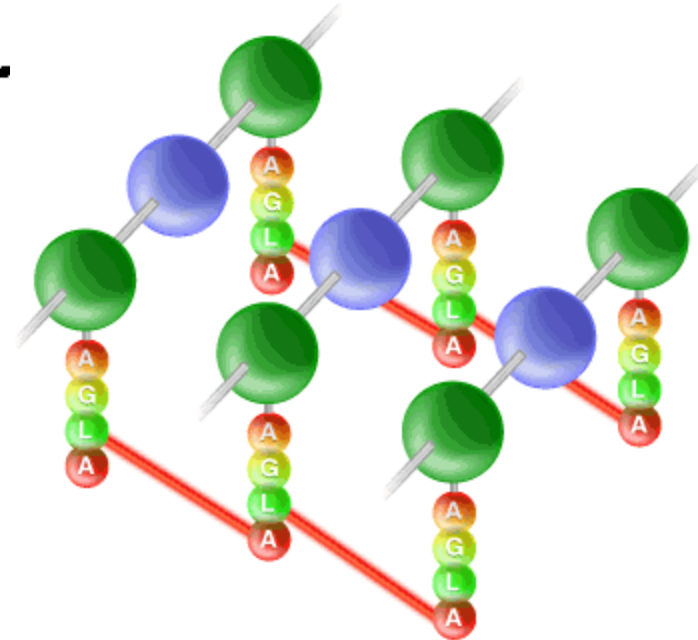
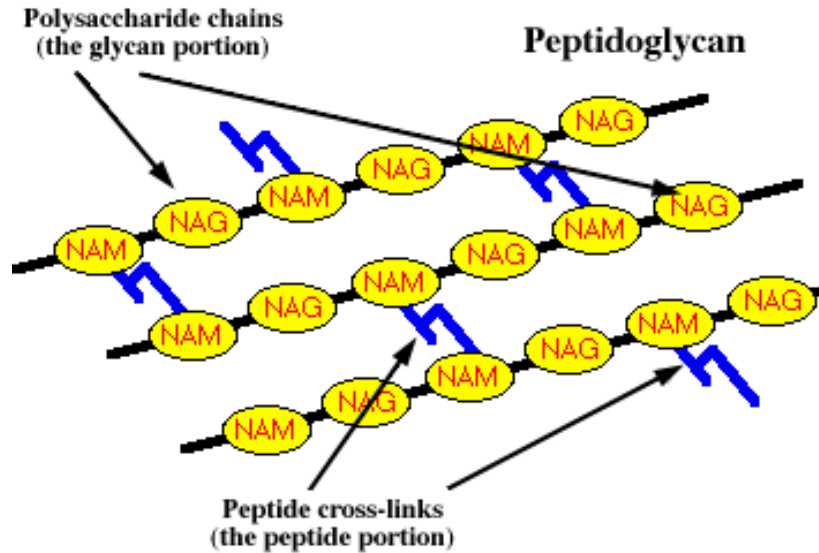
20

- Çapraz bağlanmış,
- Tek makromolekül
- Hücreyi sarar
- Hücrenin sertliğini sağlar

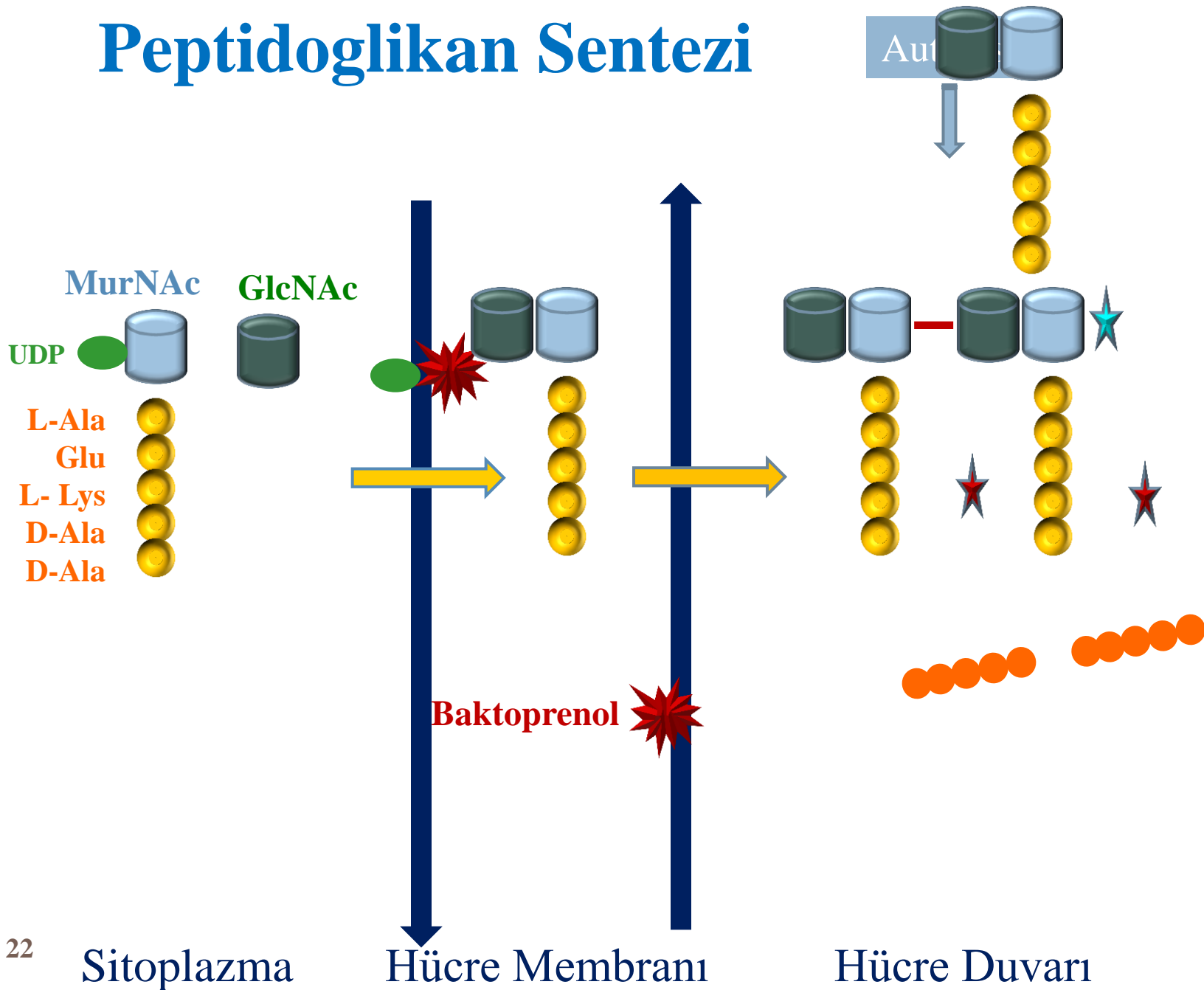


# Peptidoglikan Yapısı

21

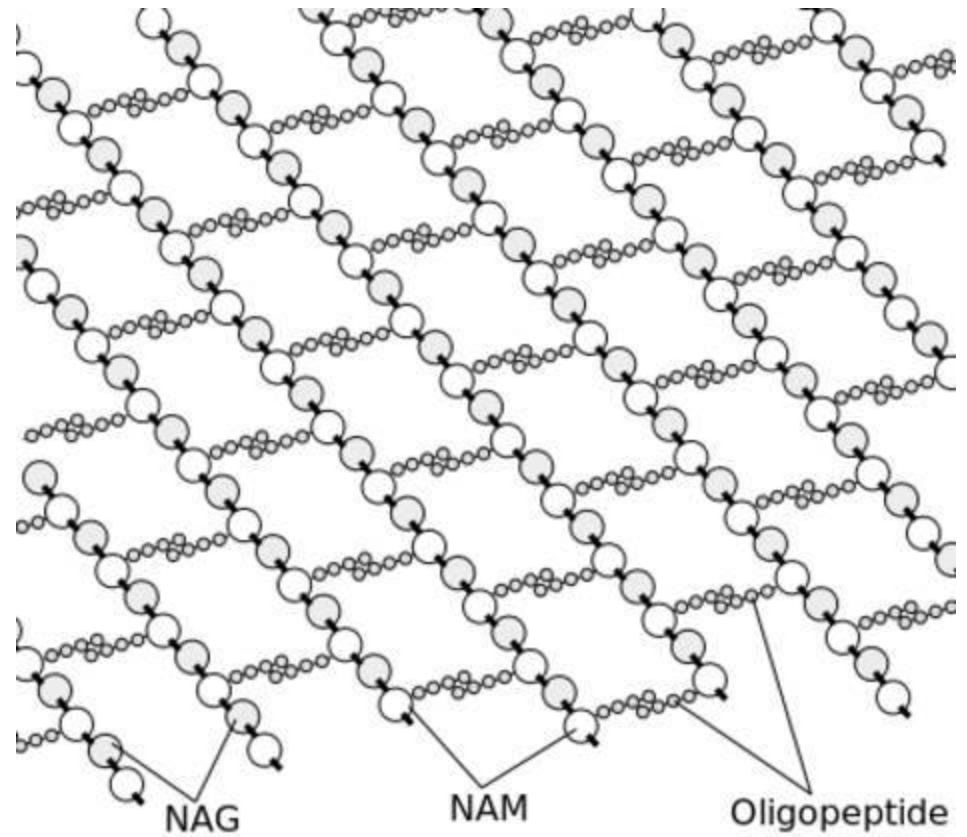
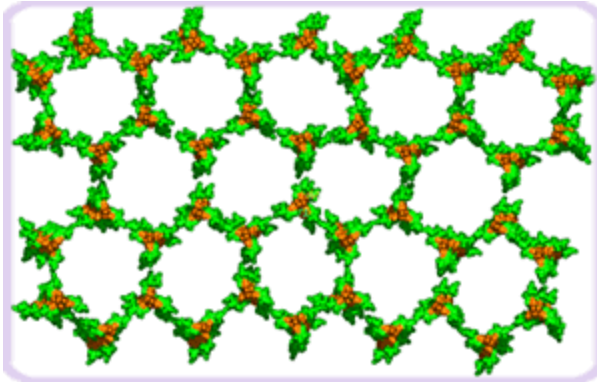


# Peptidoglikan Sentezi



# Peptidoglikan

23



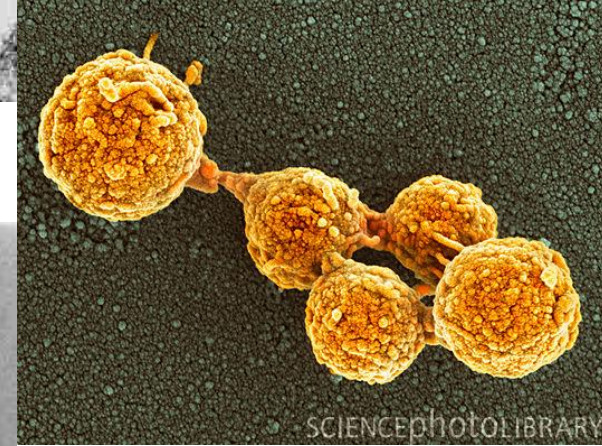
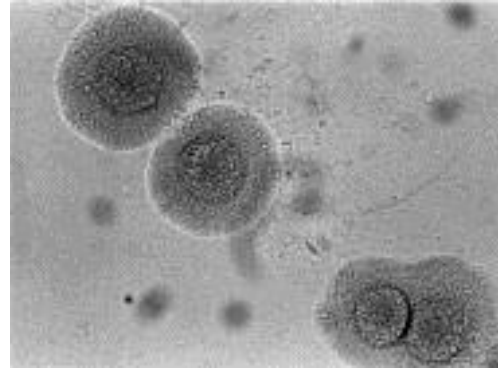


# Hücre Duvarı Olmayan Genus

24

## *Mycoplasma*

- *En küçük bakteri*
- *Peptidoglikan hücre duvarı yok*
- *Sentetik besiyerinde ürer*



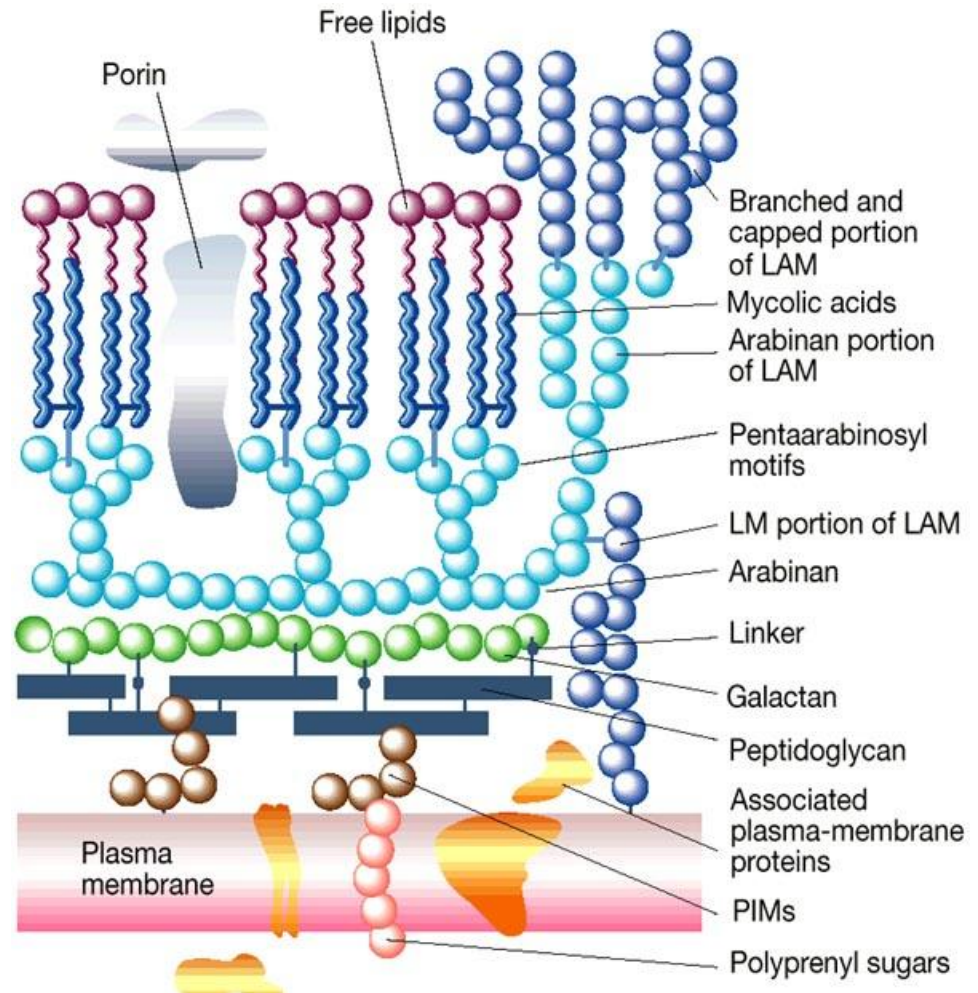


# Mycobacterium

25

## Hücre duvarı komponentleri:

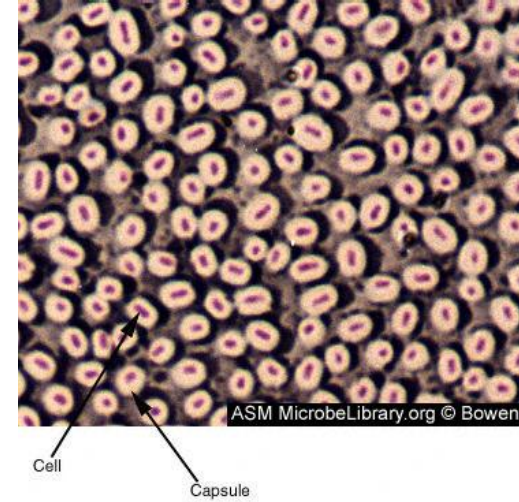
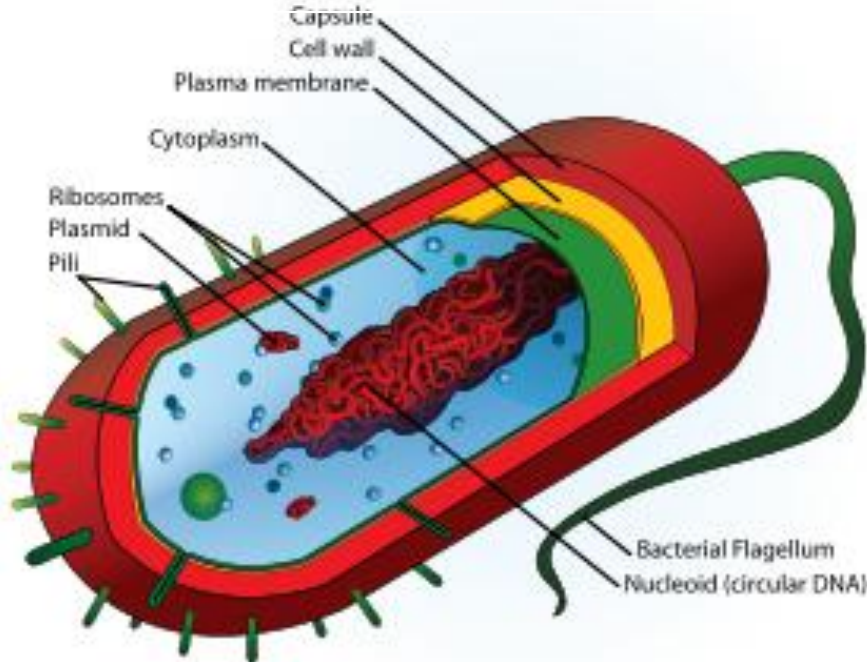
- Peptidoglycan tabaka
- Arabinogalactan
- Cord factor
- Wax D lipid
- Mycolic acid



# Kapsül

26

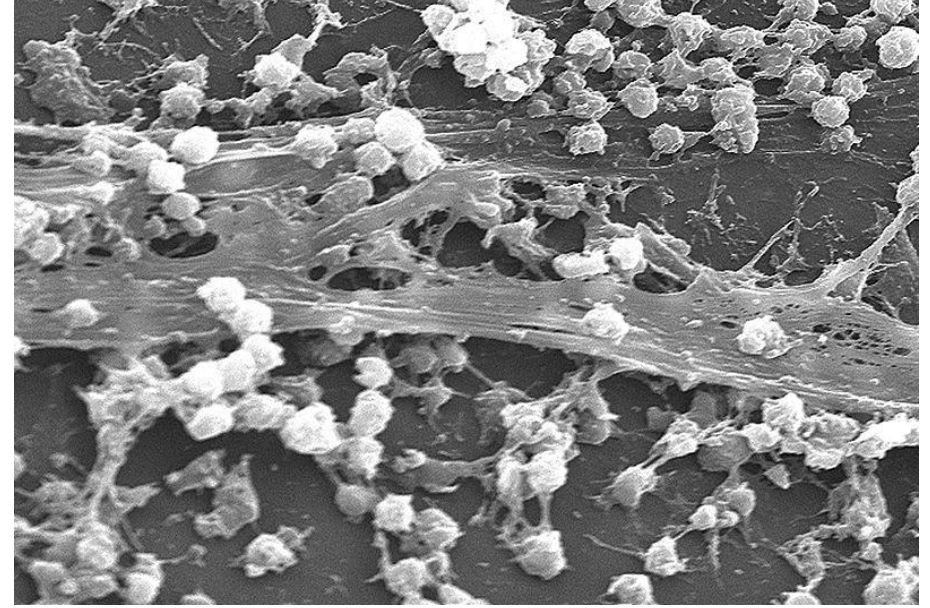
- Genellikle Polisakkarit
- Hücre duvarına sıkı bağlı
- major virulans faktörü- hücre adezyonu  
anti fagositoz



# Slime tabakası

27

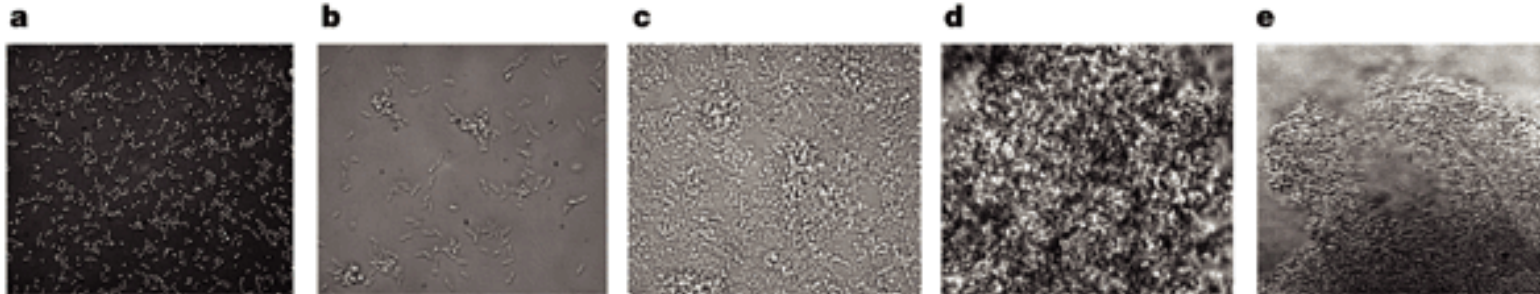
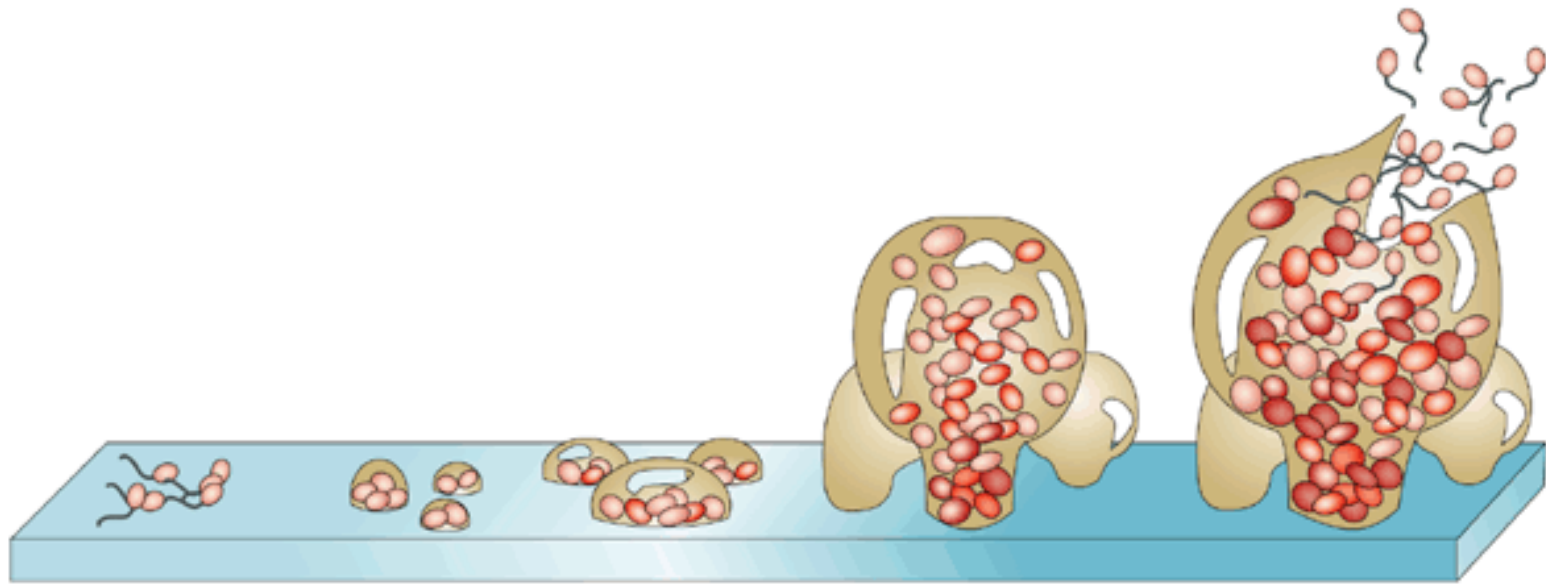
- Polisakkarit
- Hücre duvarına gevşek bağlı
- Biyofilm oluşturur
- Konak savunma ve antibiyotiklerden korunmada rol oynar





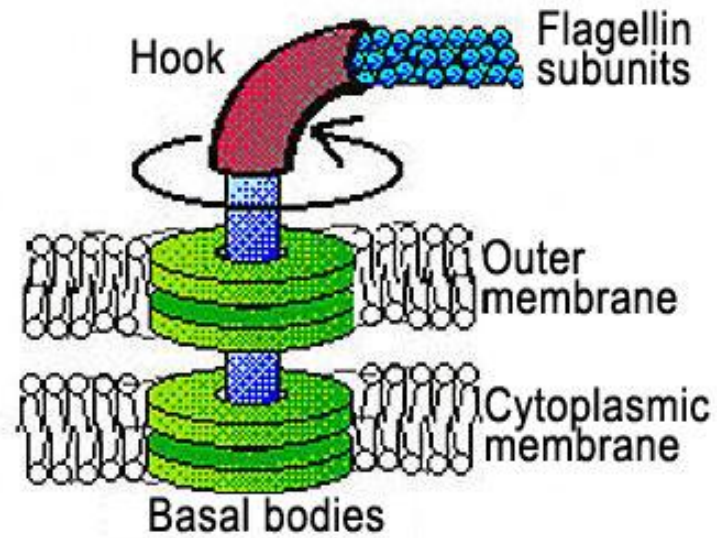
# Biofilm Tabakası

28



# Flajella

29

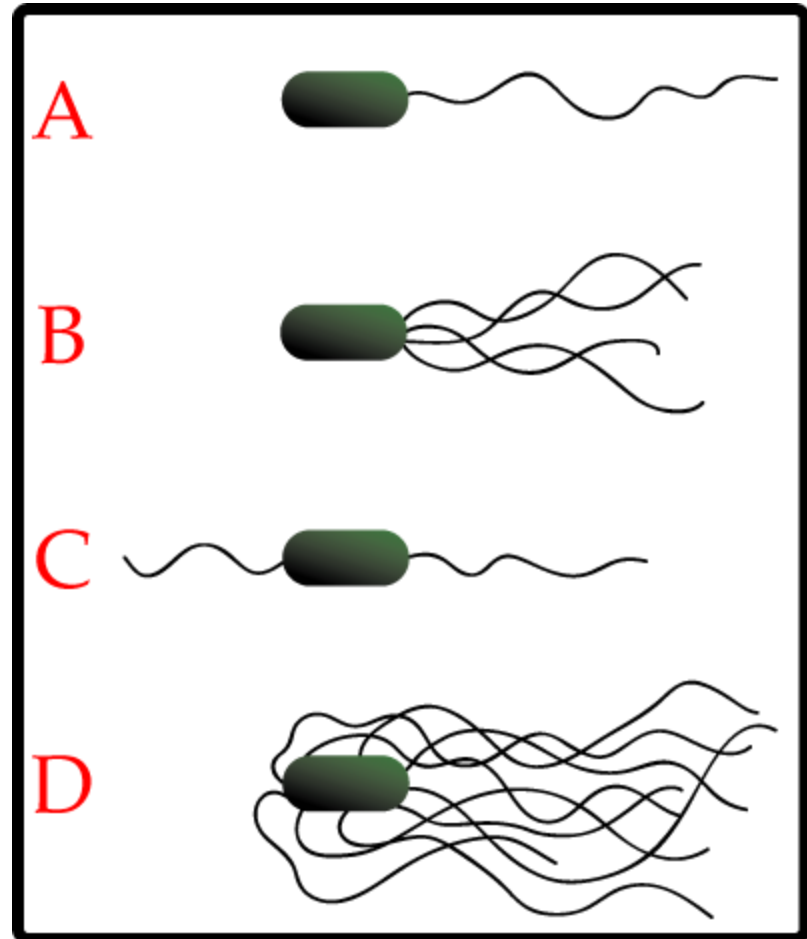


ASM MicrobeLibrary.org © Merkel

# Flajella

30

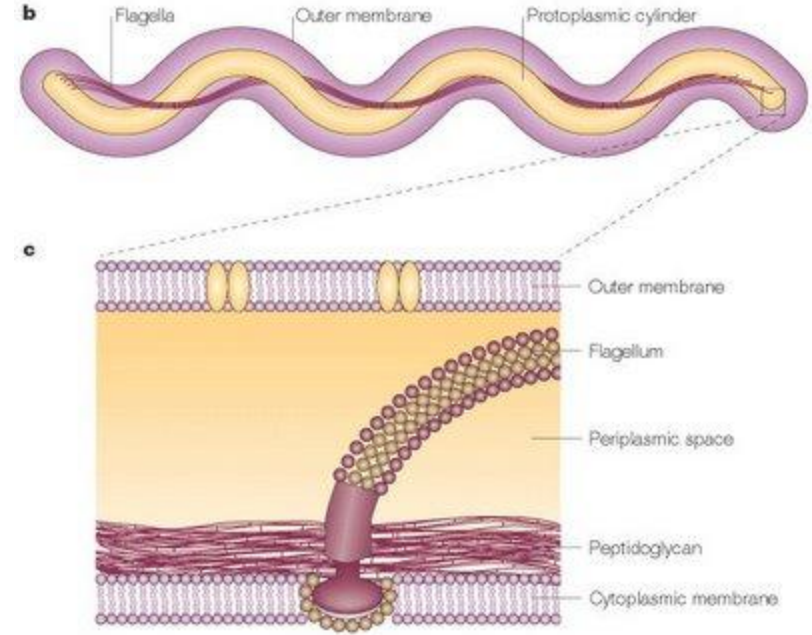
- A) Monotrichous
- B) Lophotrichous
- C) Amphitrichous
- D) Poritrichous



# Axial filament

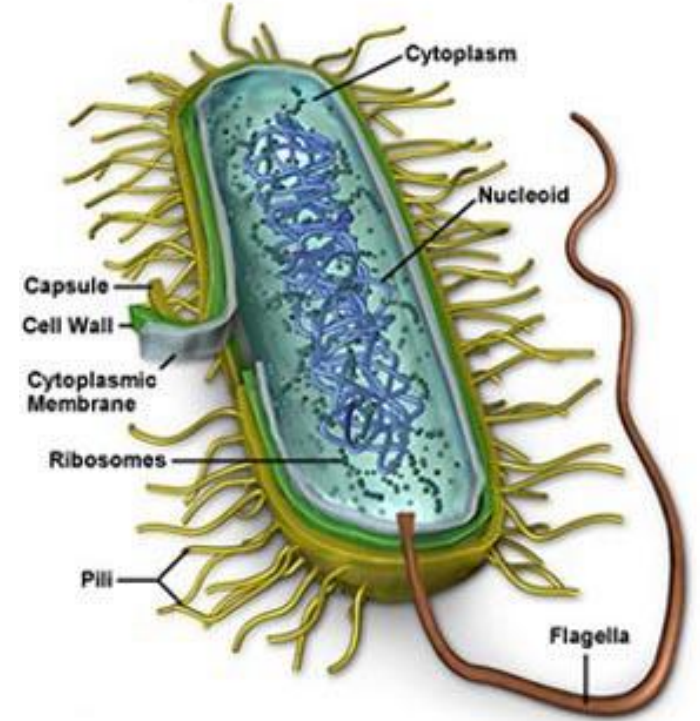
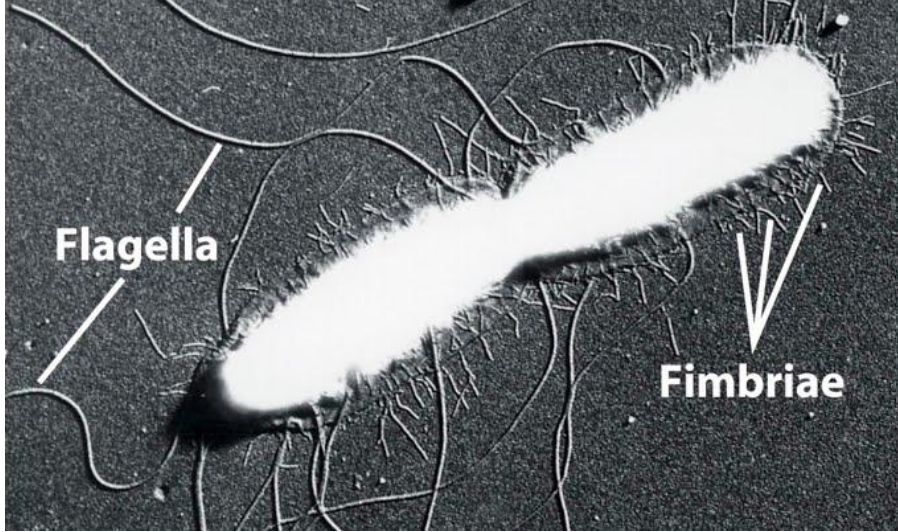
31

- ❑ Spiroketlerde bulunur
- ❑ Hücre membranından çıkar
- ❑ Periplazmik aralıkta bulunur
- ❑ Flagella benzeri fonksiyon



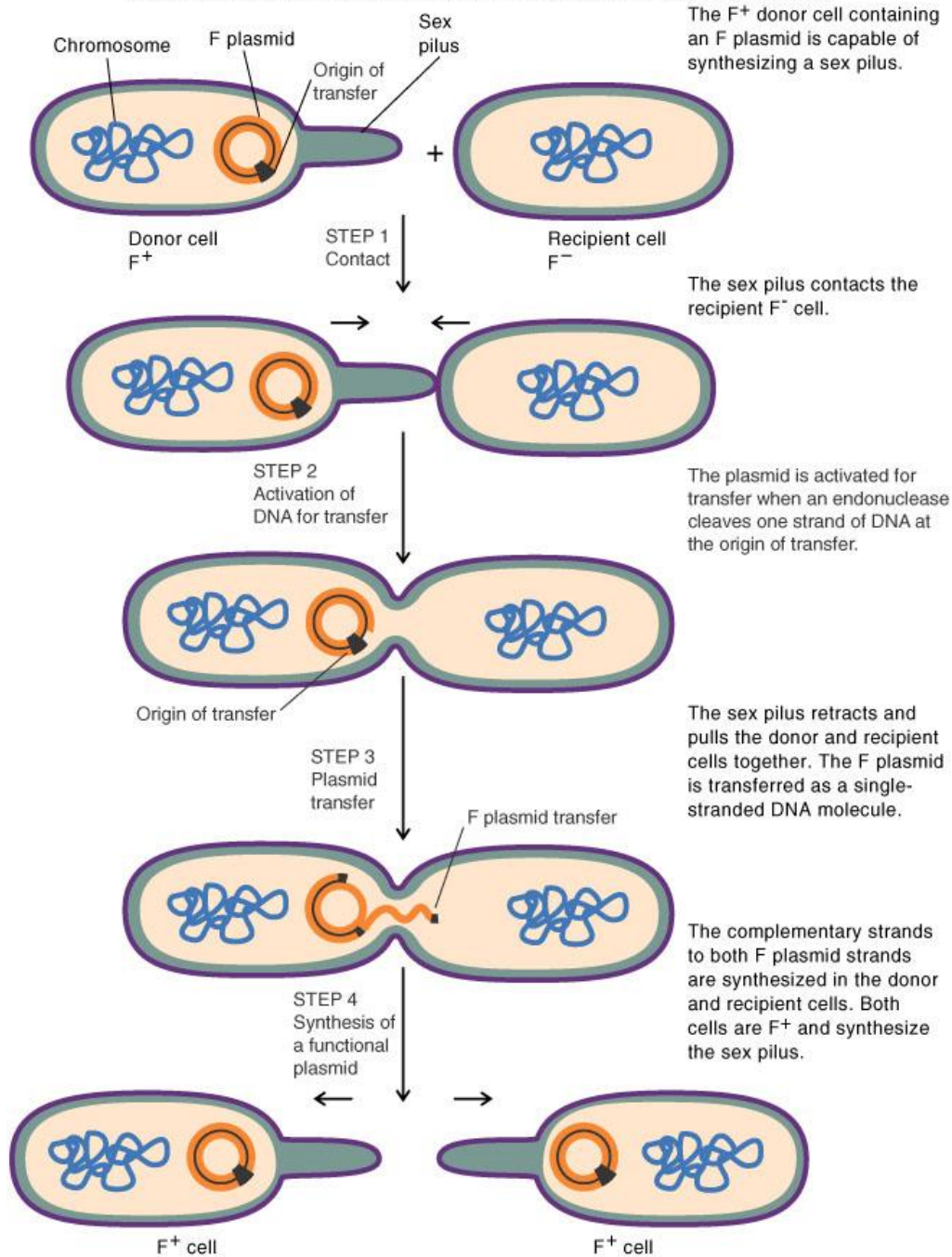
# Pili (fimbria)

32



- Pilin proteinlerinden oluşmuştur
- Peritişöz
- Adezyondan sorumlu (P fimbriae)
- Seksuel konjugasyon (sex pilus-F Fimbria)

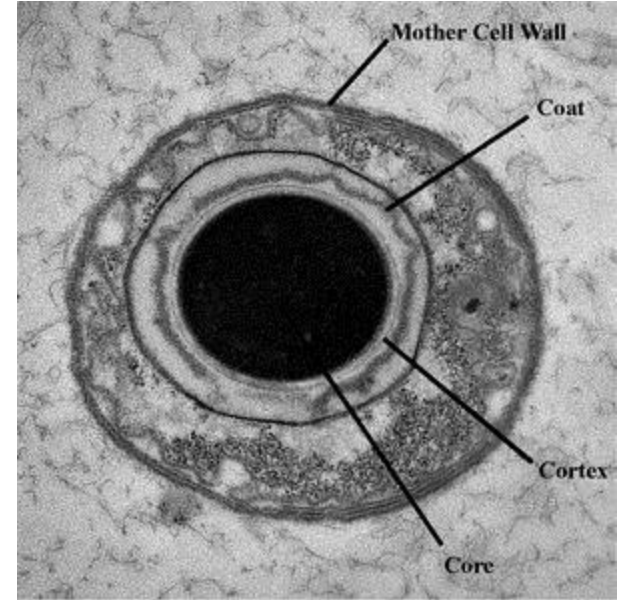




# Sporlar

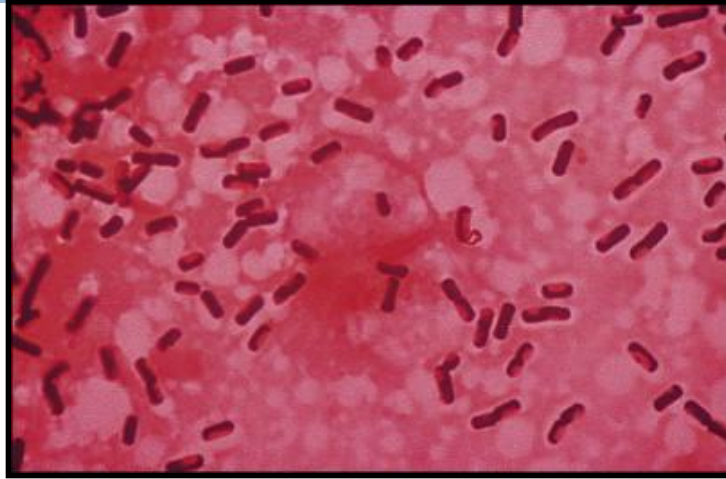
34

- **Sadece Gram pozitif bakteriler üretir**
- **Zor koşullarda üretilir**
  - **Kromozomun tam kopyası**
  - **Kalsiyum dipikolonat içerir**

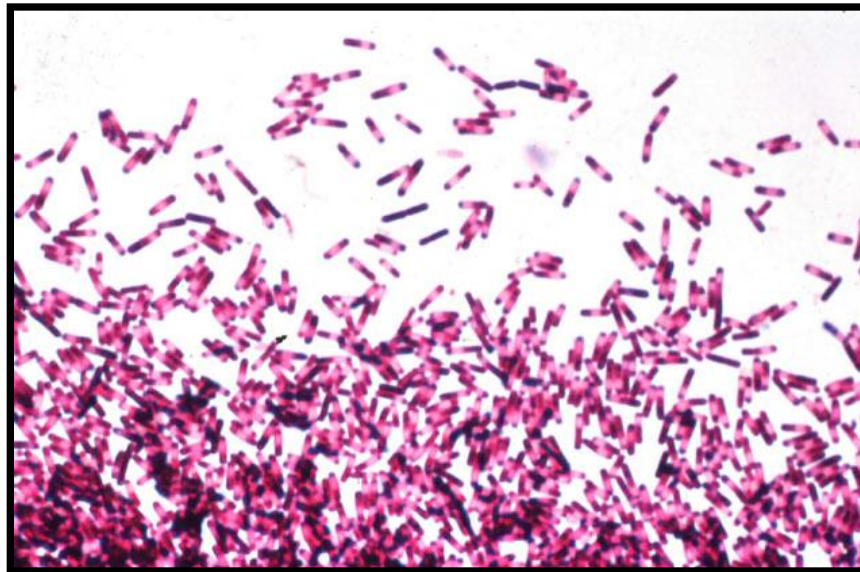


# Spores

35



Direkt örnek



Kültürden örnek

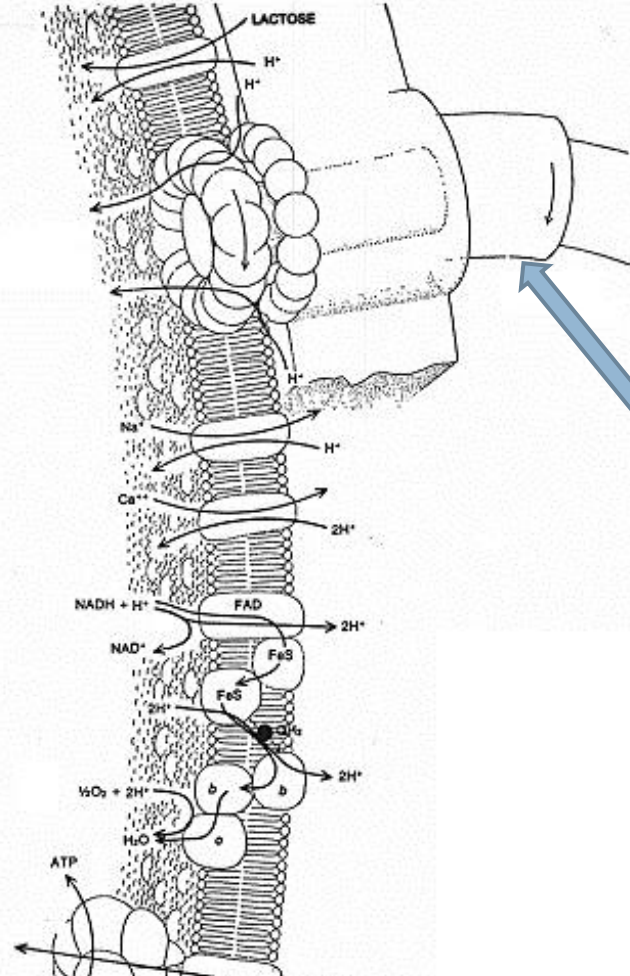
# Sitoplazmik Membran

36

Sterol Yok

## Fonksiyonları:

- Elektron transportu
- Enerji üretimi
- Transport



Flajella

Oksidatif fosforilasyon hücre membranında gerçekleşir  
(Mitokondri yok).

# Sitoplazmik Yapılar

37

DNA

Ribozomlar

Proteinler

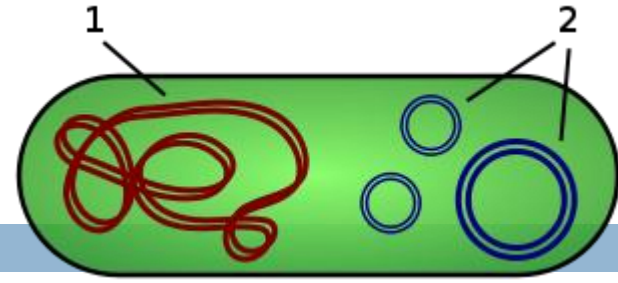
Metabolitler

Plazmidler

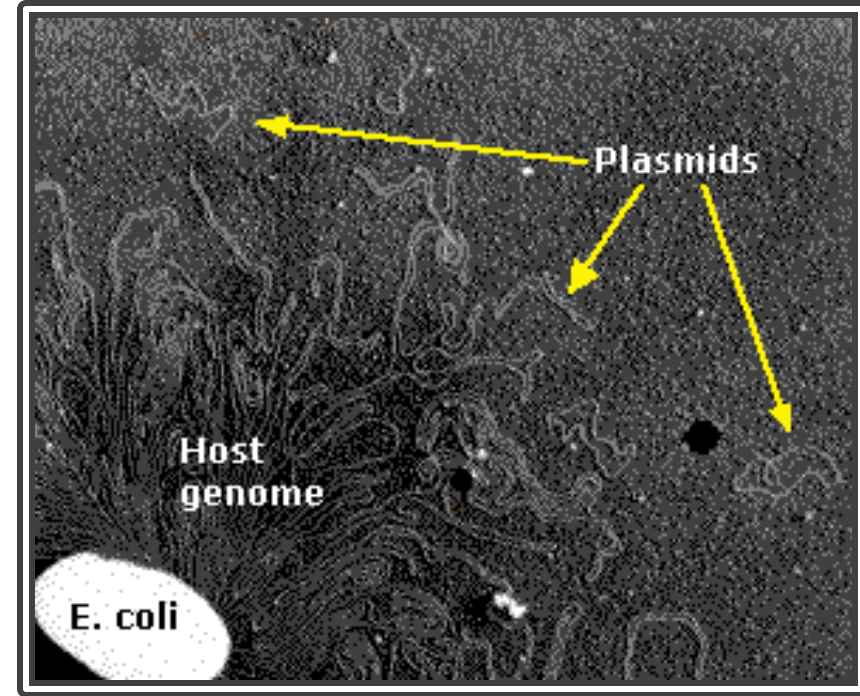




# Plazmidler



- Çembersel, çift iplikli DNA  
1500-400,000 bç
- Kendisi replike olabilir
- Bazıları kormozoma integre olur  
(integron)
- Genellikle gram negatif bakteriler
- Pathogenez faktörleri
- Antibiyotik direnç faktörleri kodlar  
Bakteriye avantaj sağlar



# DNA Replikasyonu

İki yönlü  
Yeni iplikte yeni sentez başlar

**The daughter cells are  
"born pregnant."**

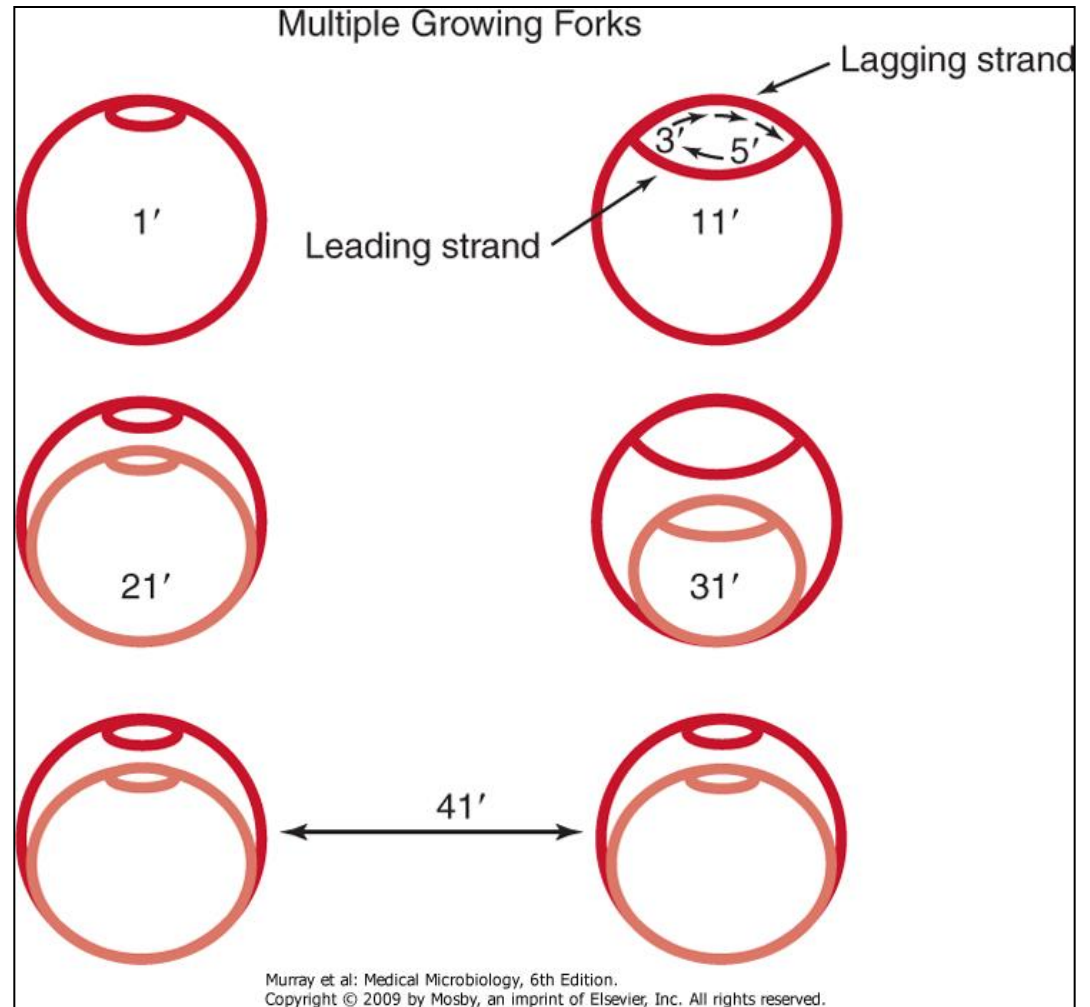


Figure 3-9 Bacterial DNA replication. New DNA synthesis occurs at growing forks and proceeds bidirectionally. DNA synthesis progresses in the 5' to 3' direction continuously (leading strand) or in pieces (lagging strand). Assuming it takes 40 minutes to complete one round of replication, and assuming new initiation every 20 minutes, initiation of DNA synthesis precedes cell division. Multiple growing forks may be initiated in a cell before complete septum formation and cell division.

# Hücre bölünmesi

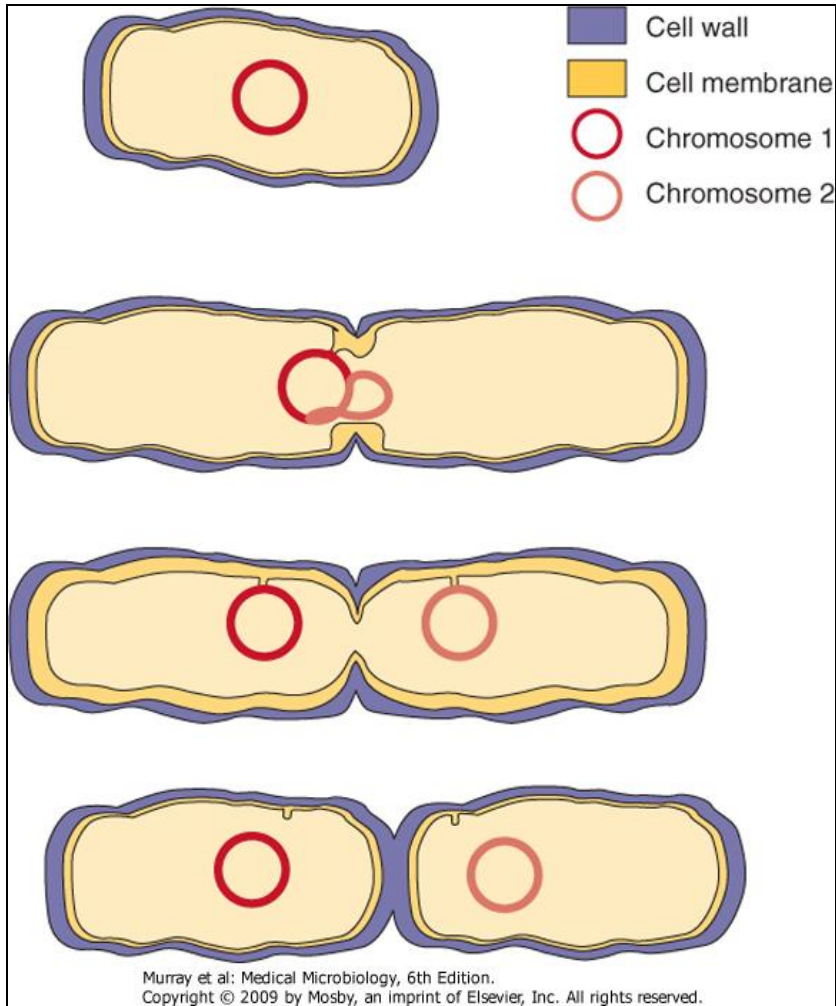


Figure 3-10 Bacterial cell division. Replication requires extension of the cell wall and replication of the chromosome and septum formation. Membrane attachment of the DNA pulls each daughter strand into a new cell.

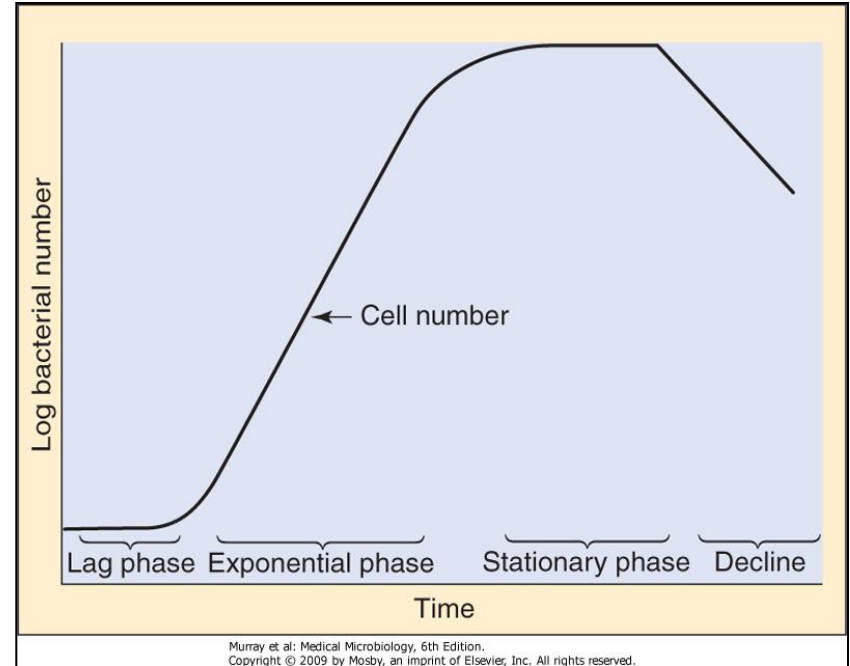
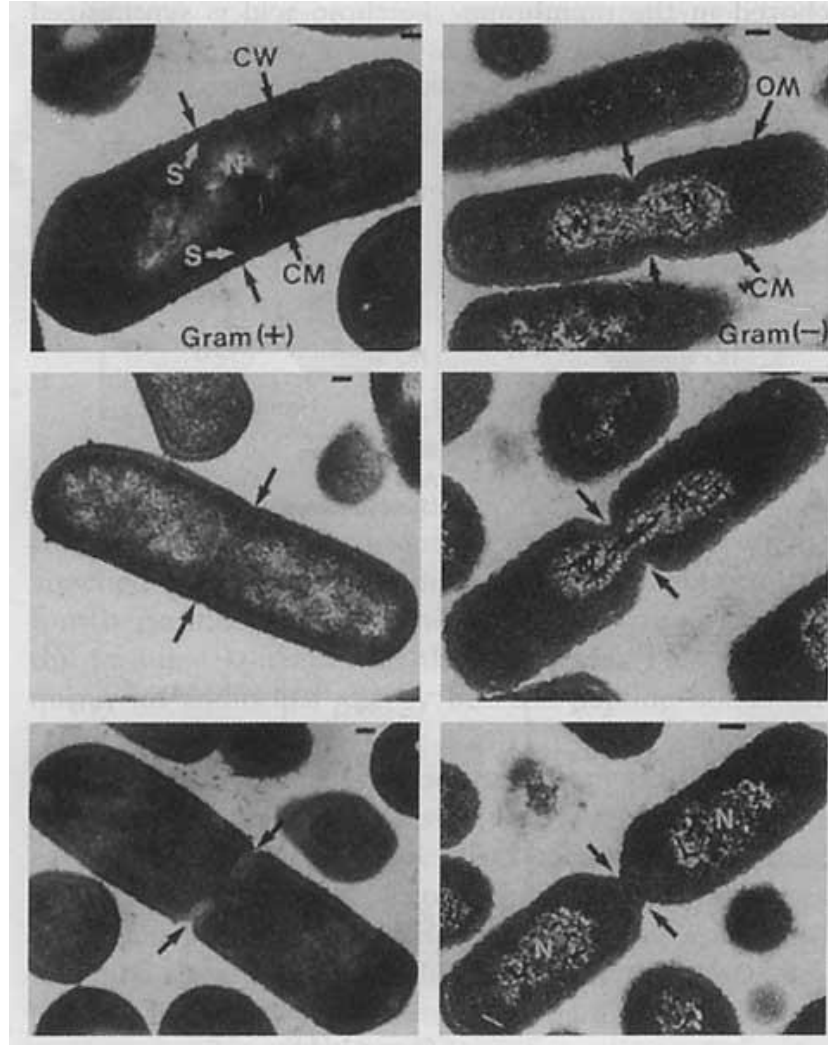


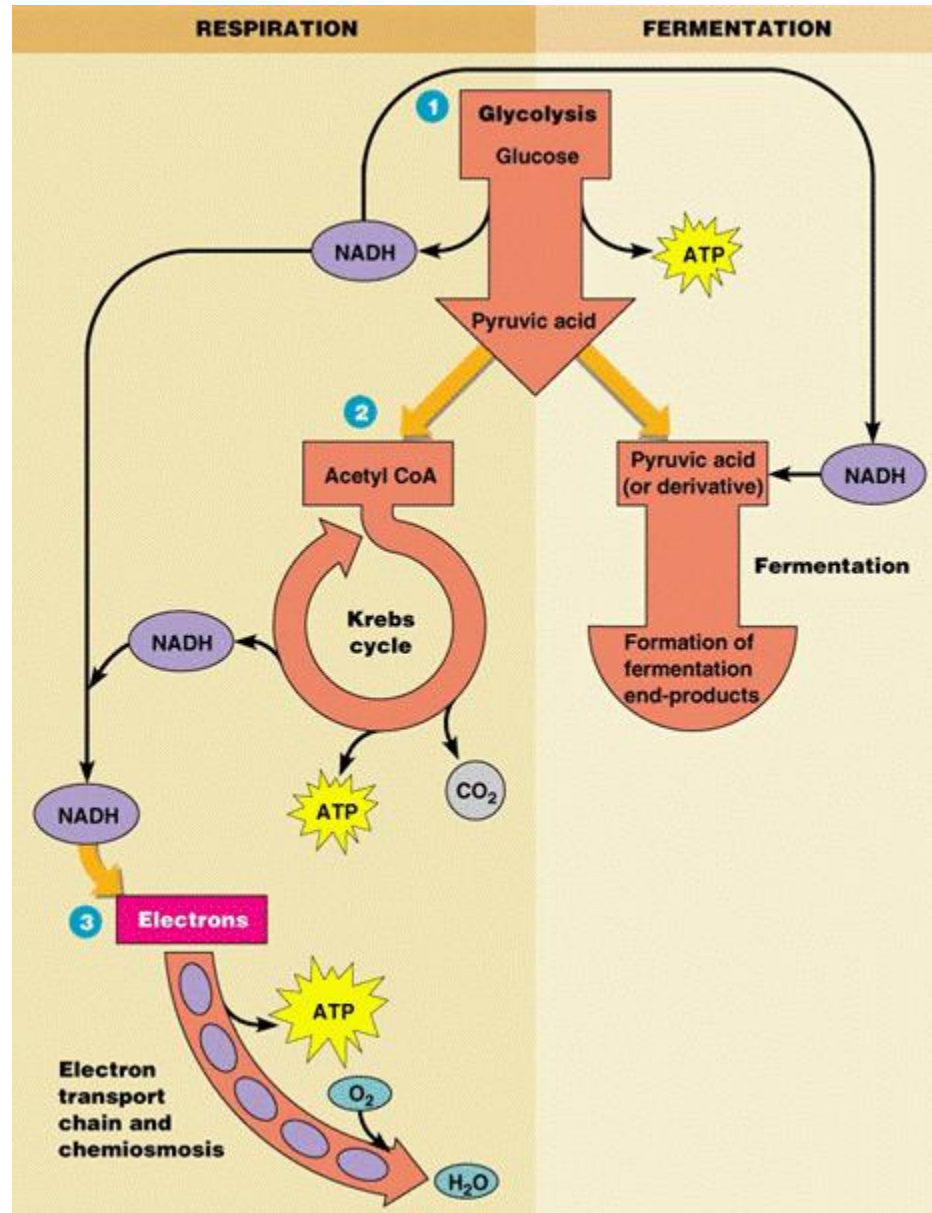
Figure 3-11 Phases of bacterial growth, starting with an inoculum of stationary-phase cells.

# Prokaryotic Cell Division

42



# Microbial Metabolism

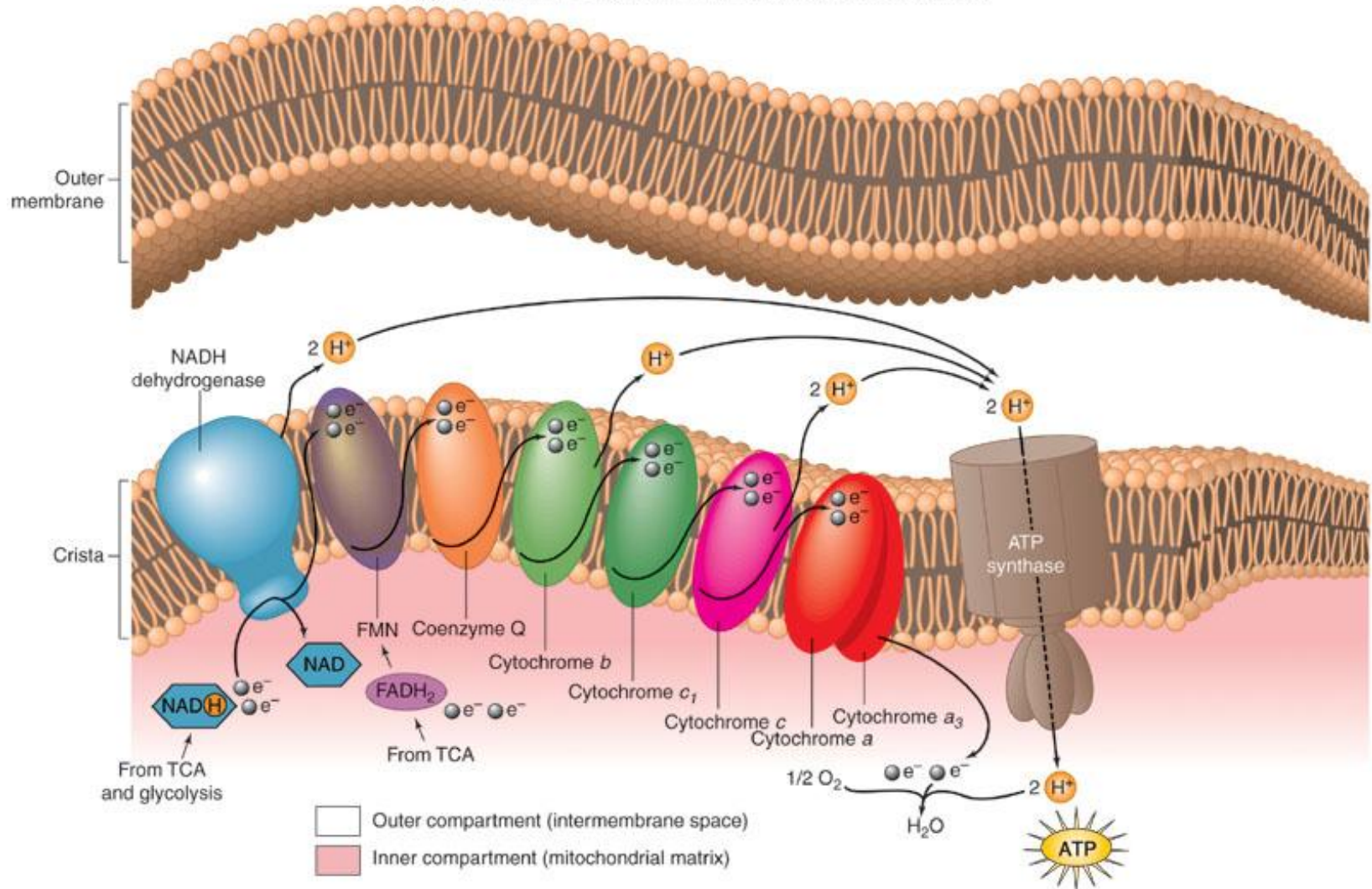




# Electron transport system

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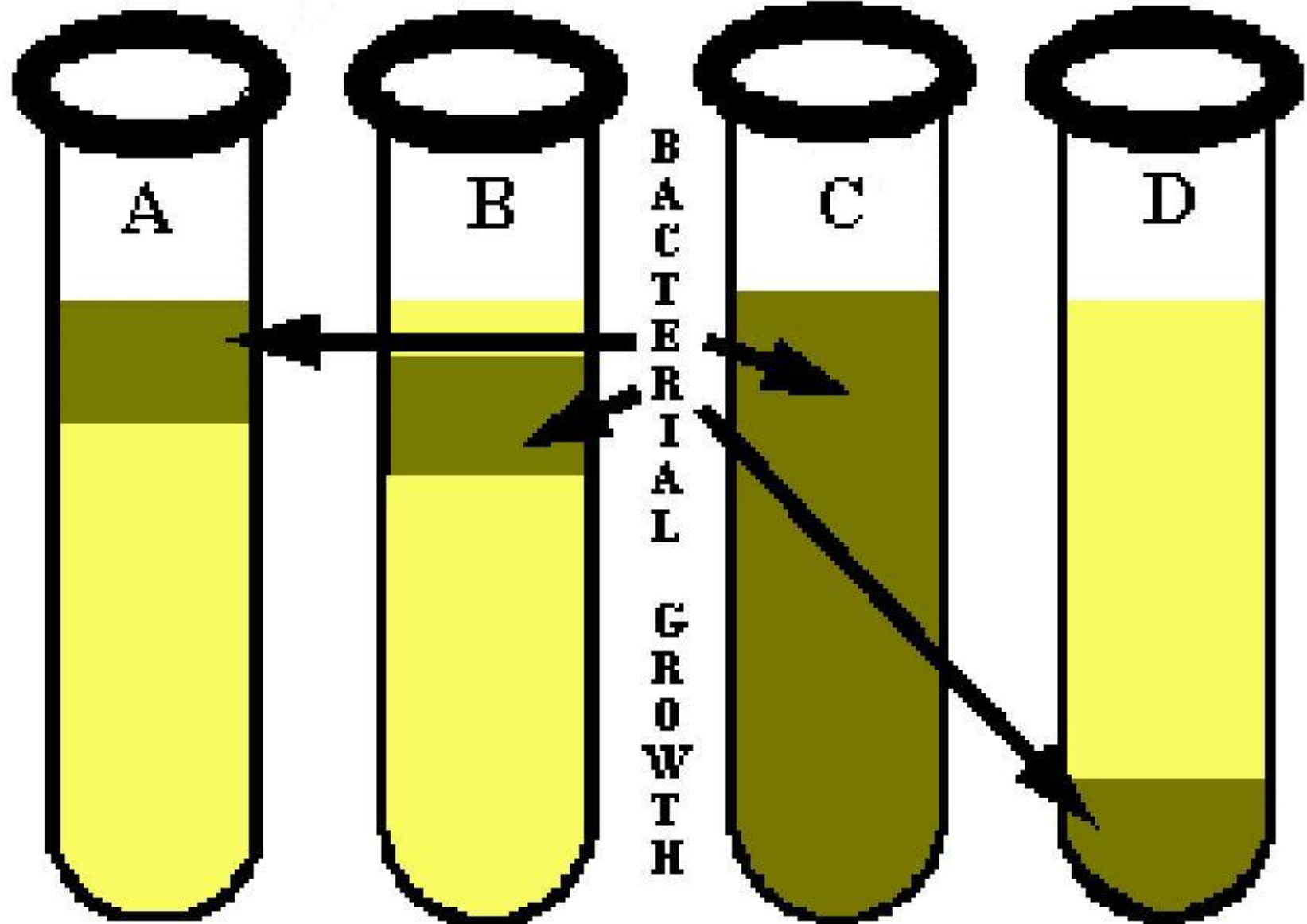




# Enerji üretimi

	Pathways involved	Final e-acceptor	ATP yield
Aerobic respiration	Glycolysis, TCA, ET	O <sub>2</sub>	38
Anaerobic respiration	Glycolysis, Fermentation	Organic molecules	2

OBLIGATE MICRO FACUL- OBLIGATE  
AEROBE AEROPHILIC TATIVE ANAEROBE



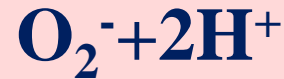
# Zorunlu Anaeroplur

47

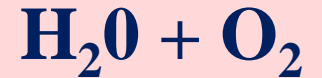
**YOK**



**süperoksit dismutaz**



**katalaz**



**peroksidaz**



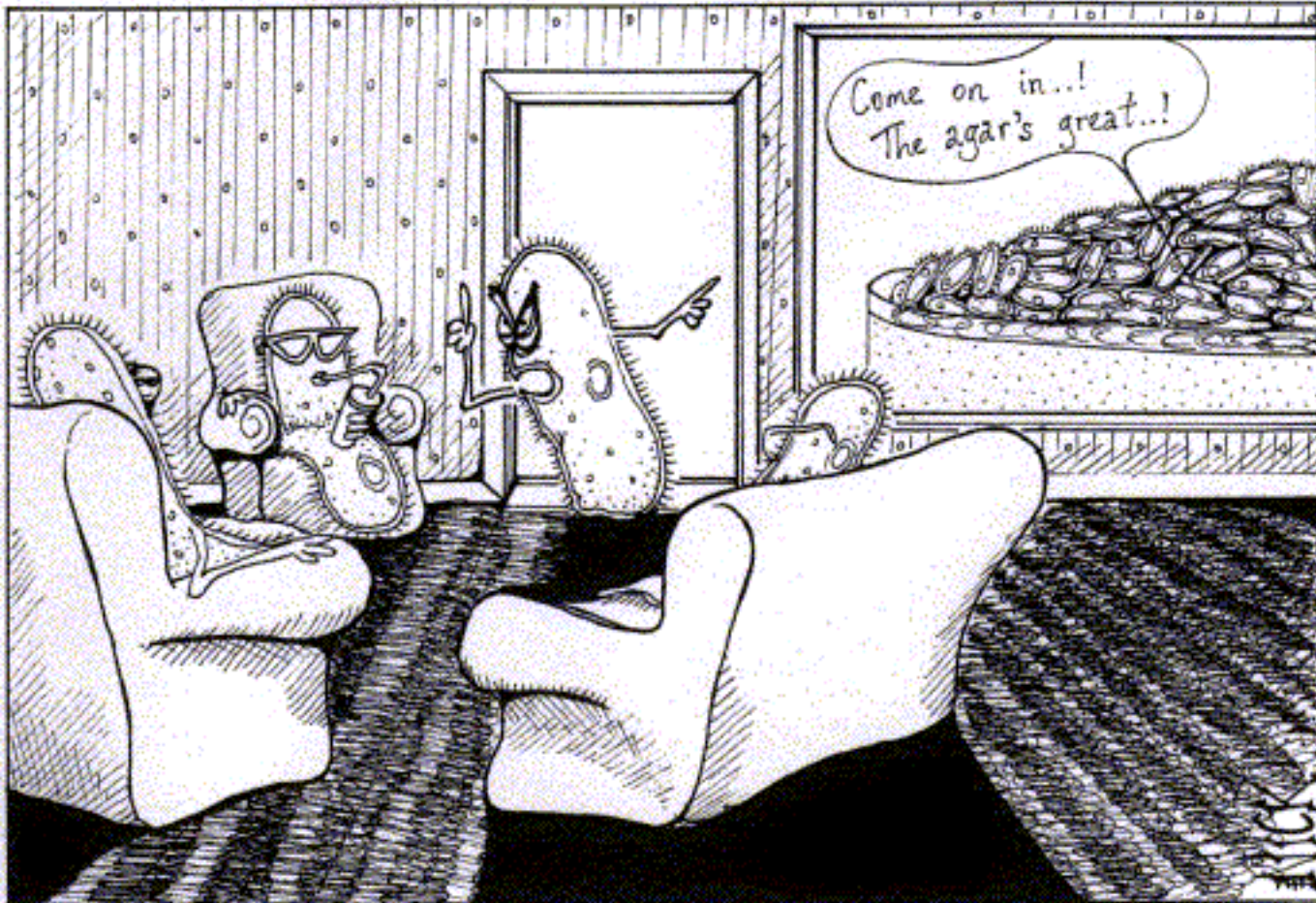
**Oksijen ile ölür**

# Aerotoleran anaeroplur

48

- Sadece fermentasyon
- Oksijen varlığında yaşayabilir

# Microbial Growth!



*" I wish you'd learn to put the lid on your Petri Dish, Harry...! We came here with four kids and now it looks like we've got twenty million !! "*