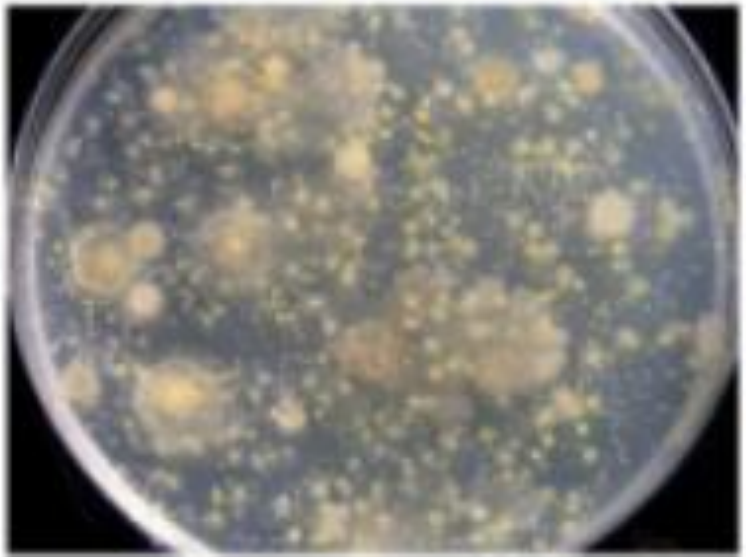
Go to the "Slide Show" shade above

Click on "Play from Beginning"

Bacteria, Protists, Fungi
Chapters 21-23



WARM-UP

Taxonomy & Viruses

Give the taxonomic order from MOST specific to LEAST specific (8 categories).

How do scientists name organisms?

Define a virus and it s components.

Distinguish virus, viroid, and prions.

WARM-UP

Taxonomy & Viruses

Give the taxonomic order from MOST specific to LEAST specific (8 categories).

Variety → species → genus → family → order → class → phylum → kingdom → (DOMAIN)

How do scientists name organisms?

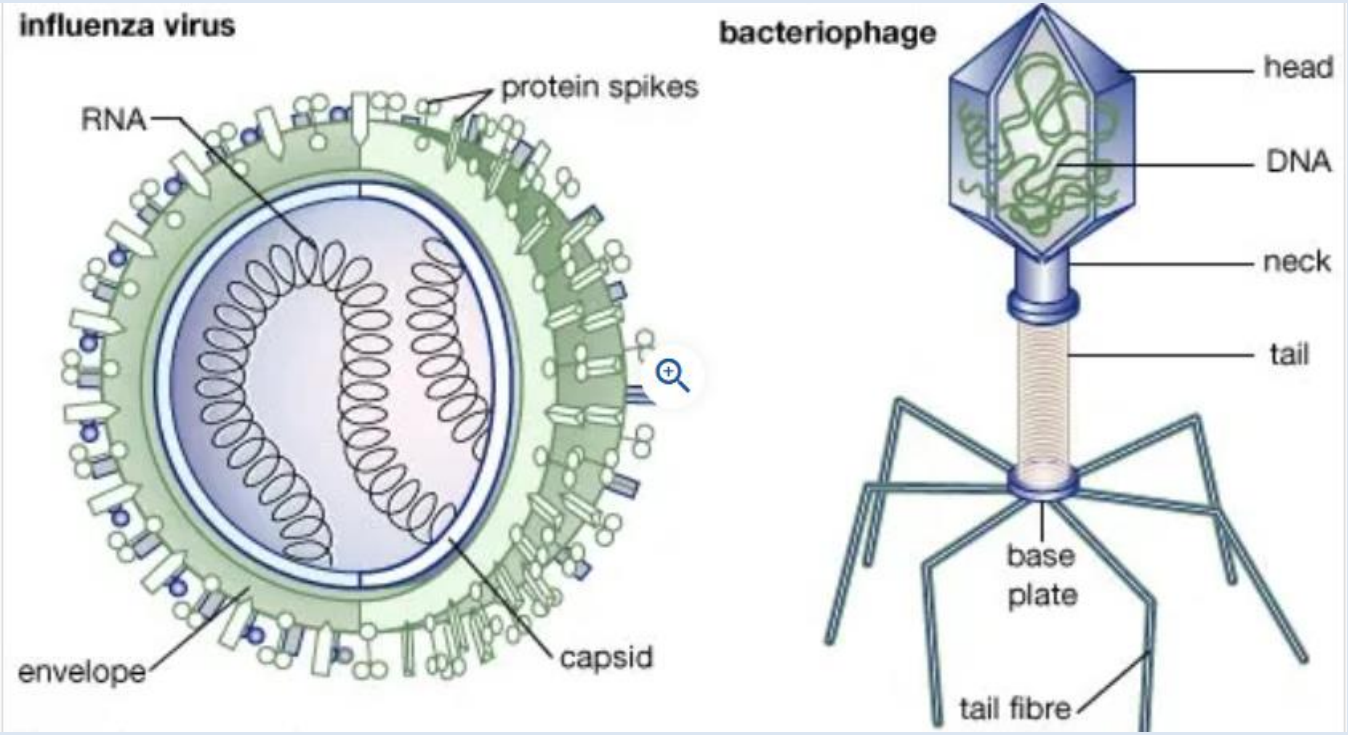
Binomial nomenclature (latin) → *GENUS species*

WARM-UP

Taxonomy & Viruses

Define a virus and it s components.

Nonliving particle that is active in cells. Anatomy consists of an envelope (lipid bilayer), capsid (protein coat) and a nucleic acid (DNA or RNA).



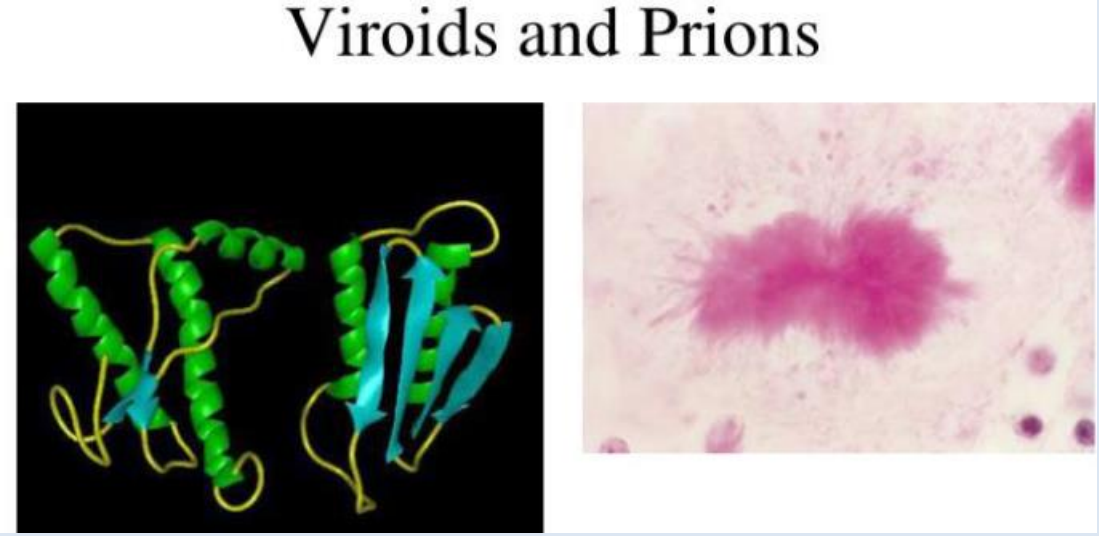
Bacteriophages attack bacteria.

WARM-UP

Taxonomy & Viruses

Distinguish virus, viroid, and prions.

	Virus	Viroid	Prion
Genome	DNA or RNA	RNA	Protein bits
Coat	Capsid or envelope		None
Target	Animal, plant, bacteria	Plants	Animals
Host	All cells	Plants	Nervous system

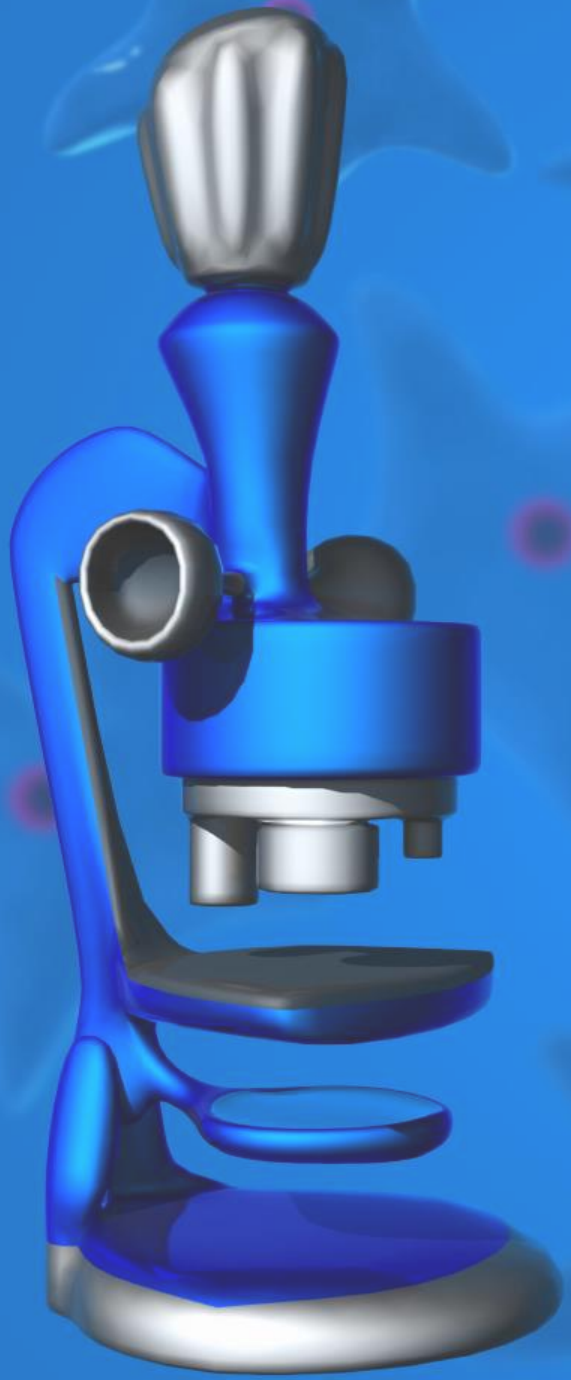


Lesson Objectives

By the end of this lesson, you should be able to:

- **Identify the characteristics of bacteria.**
- **Name and describe the two kingdoms related to bacteria.**
- **Discuss the overall importance of bacteria.**
- **Identify the characteristics of Protists.**
- **Describe the three protist groups and their characteristics.**
- **Compare and contrast the three groups of protists.**
- **Identify the characteristics shared by all fungi.**
- **Classify fungi into groups based on their methods of reproduction.**
- **Differentiate among imperfect fungi and all other fungi.**

- **Science Practice: Bacteria Protists Fungi Lab**



Kingdoms Eubacteria and Archaebacteria

Chapter 21

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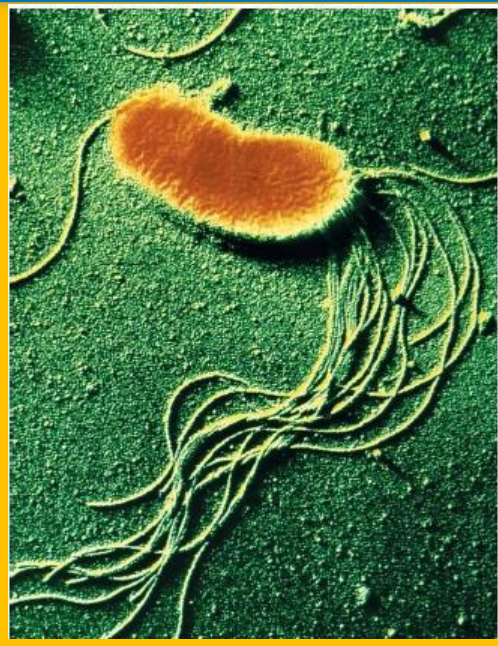
Bacteria Protists Fungi Lab (14:44)

The Bacteria



Bacteria are **Prokaryotes**.

Prokaryotic Cells:

- **No true nucleus**
- **No membrane-bound organelles**.

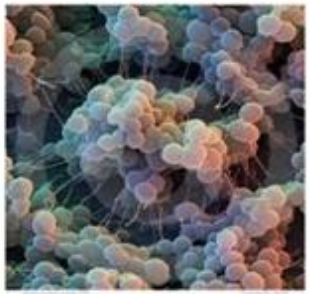
Prokaryotes are smaller than **Eukaryotic** cells

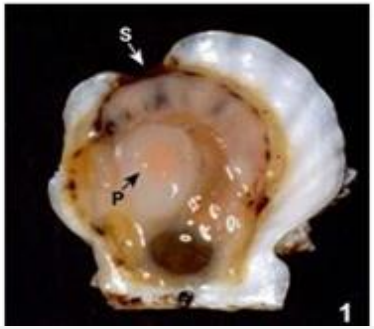
Where are Bacteria found?

- EVERYWHERE!
  - In the soil and water
  - On and in our bodies
  - In the air we breathe

- Critical to nutrient cycling as decomposers

- Some cause disease
  - Vast majority are harmless, but half of all human diseases are caused by bacteria





Bacteria exist in three basic shapes:

1. **Cocci**
   spherical

2. **Bacilli**
   rod-shaped

3. **Spirilla**
   spiral shaped

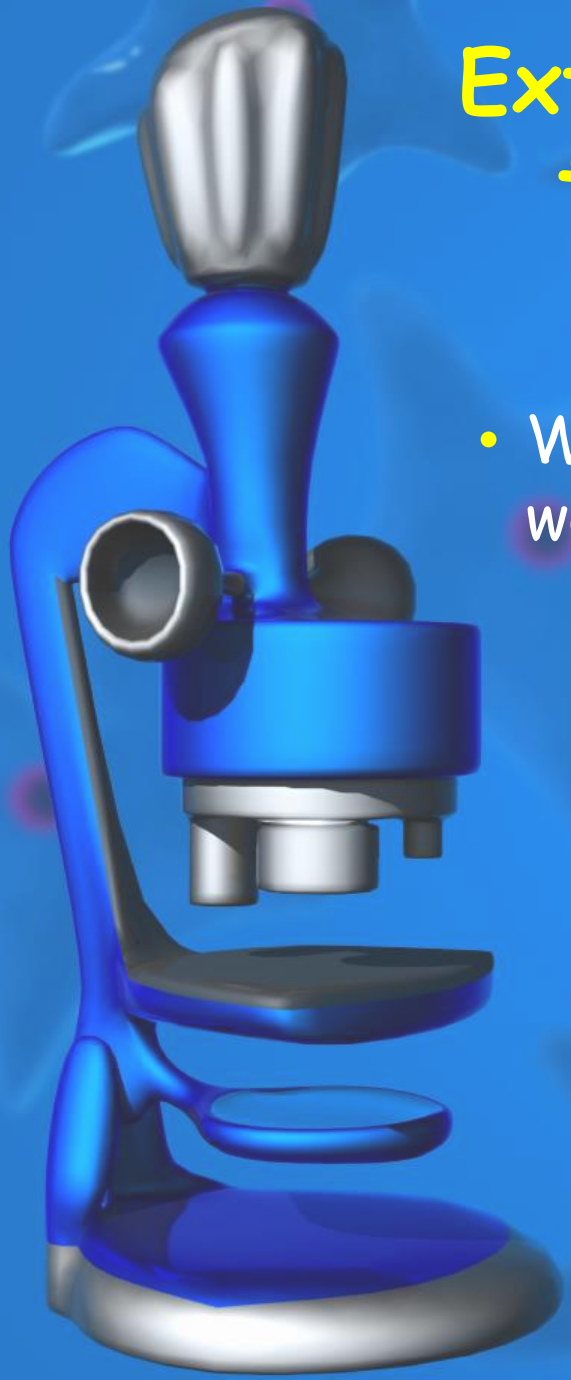
External Features contribute to the success of Prokaryotes

- Most prokaryotes have a **CELL WALL**.

CELL WALLS

  - provide physical protection
  - prevent the cell from bursting in a hypotonic environment.

- Main way of classifying bacteria is **GRAM STAIN**, which is based on the characteristics of bacterial cell walls.
- Divides bacteria in two main groups: **Gram Positive** and **Gram Negative.**

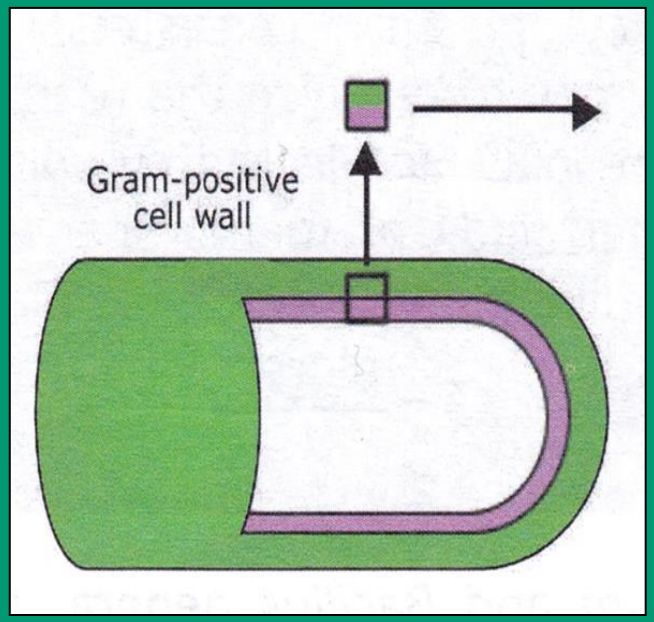


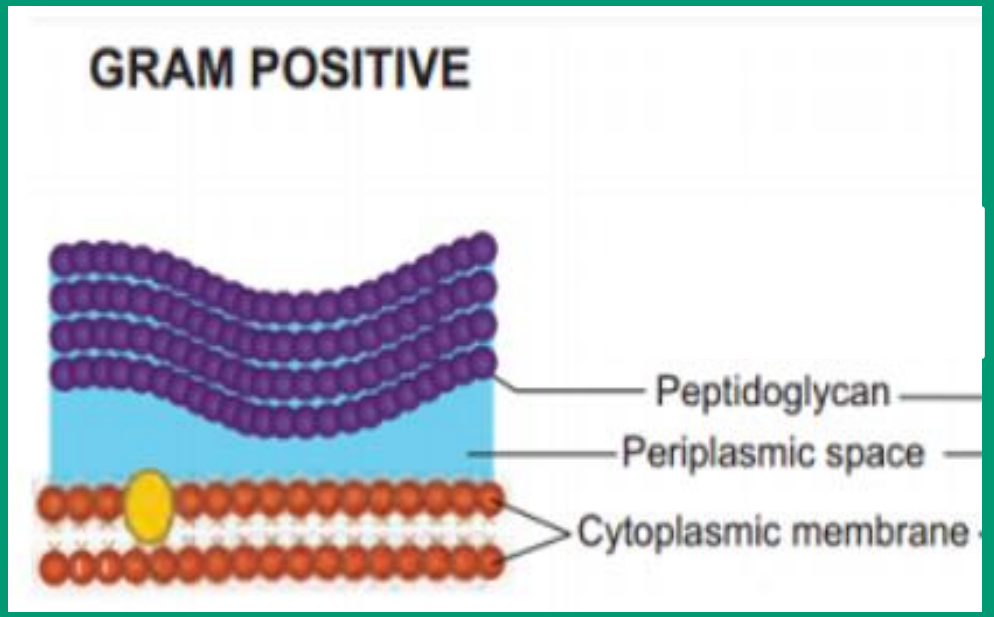
External Features contribute to the success of Prokaryotes

- When stained with **GRAM STAIN**, cell walls of bacteria are either:
  - **GRAM-POSITIVE**, with simpler cell walls containing **Peptidoglycan.**
  - **GRAM-NEGATIVE**, with less peptidoglycan. These bacteria are more complex and more likely to cause disease.

Gram Positive

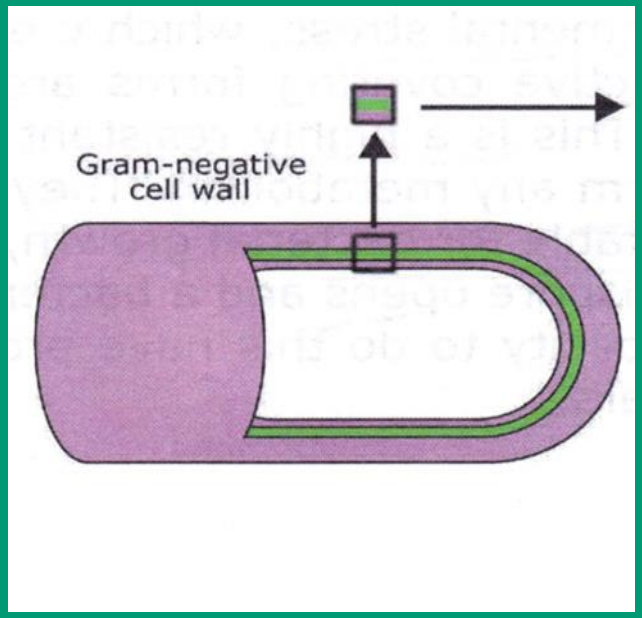
- Have thick outer layer of peptidoglycan
- Single lipid bilayer.
- Stain purple

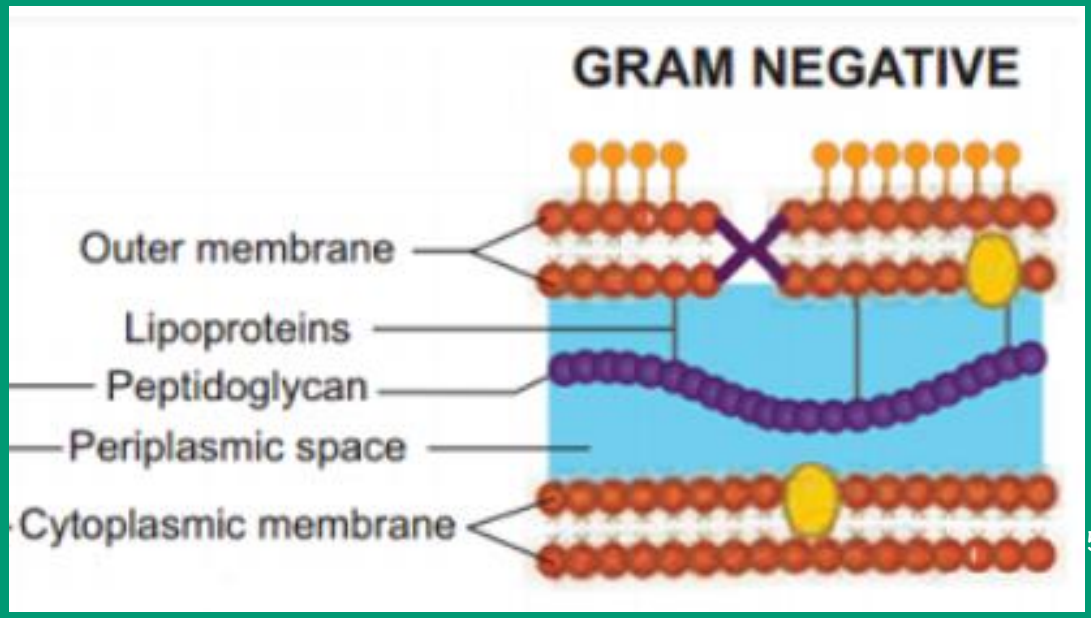




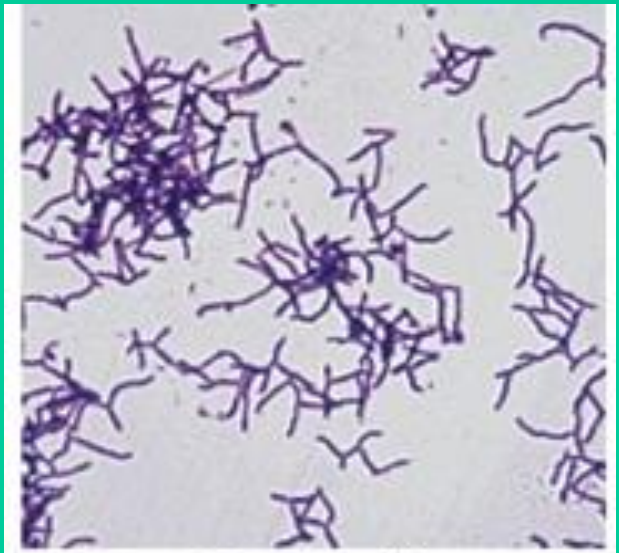
Gram Negative

- Thin layer of peptidoglycan in cell wall sandwiched between two lipid bi-layer membranes.
- Stain pink or reddish

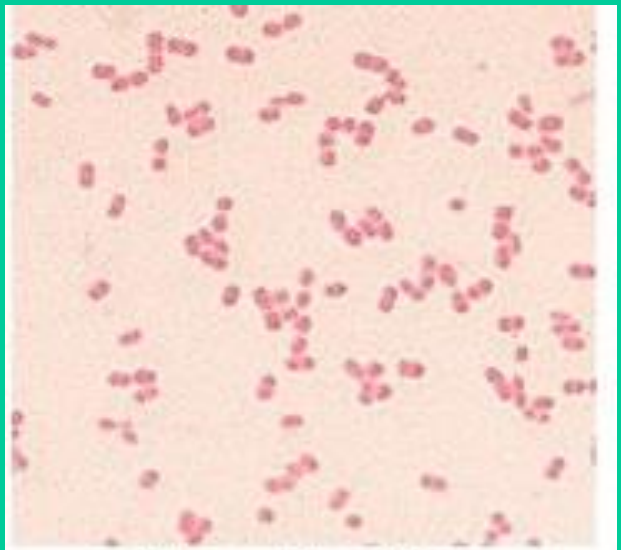




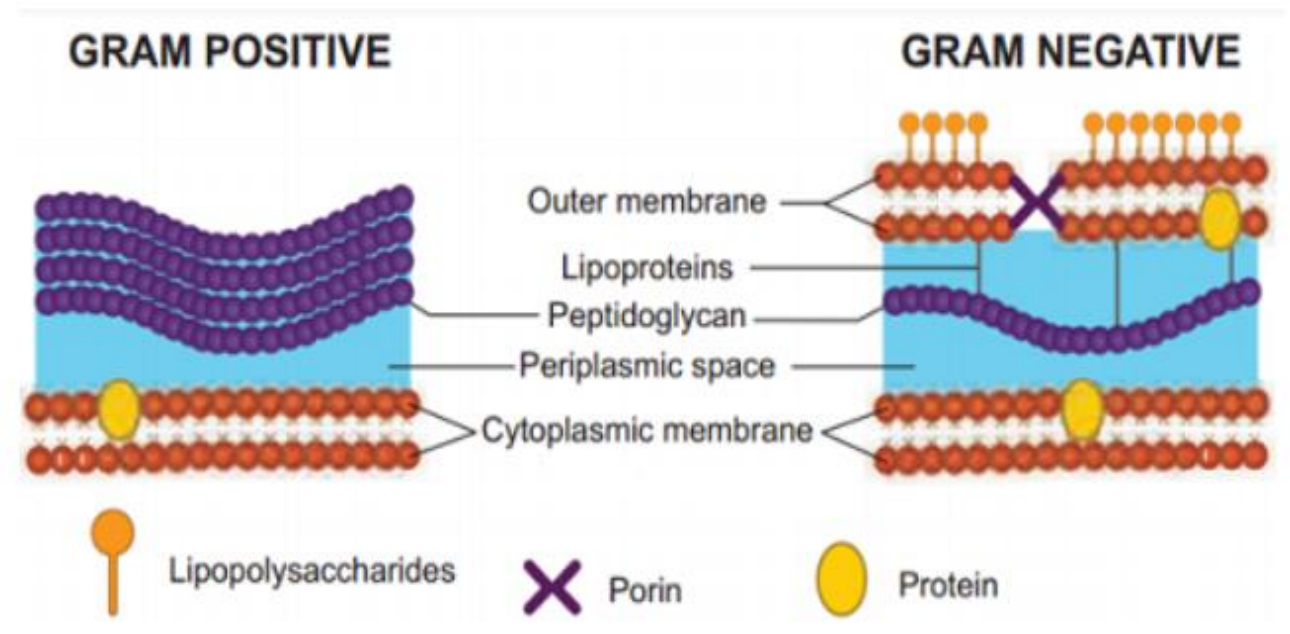
Gram Stain



Gram Positive

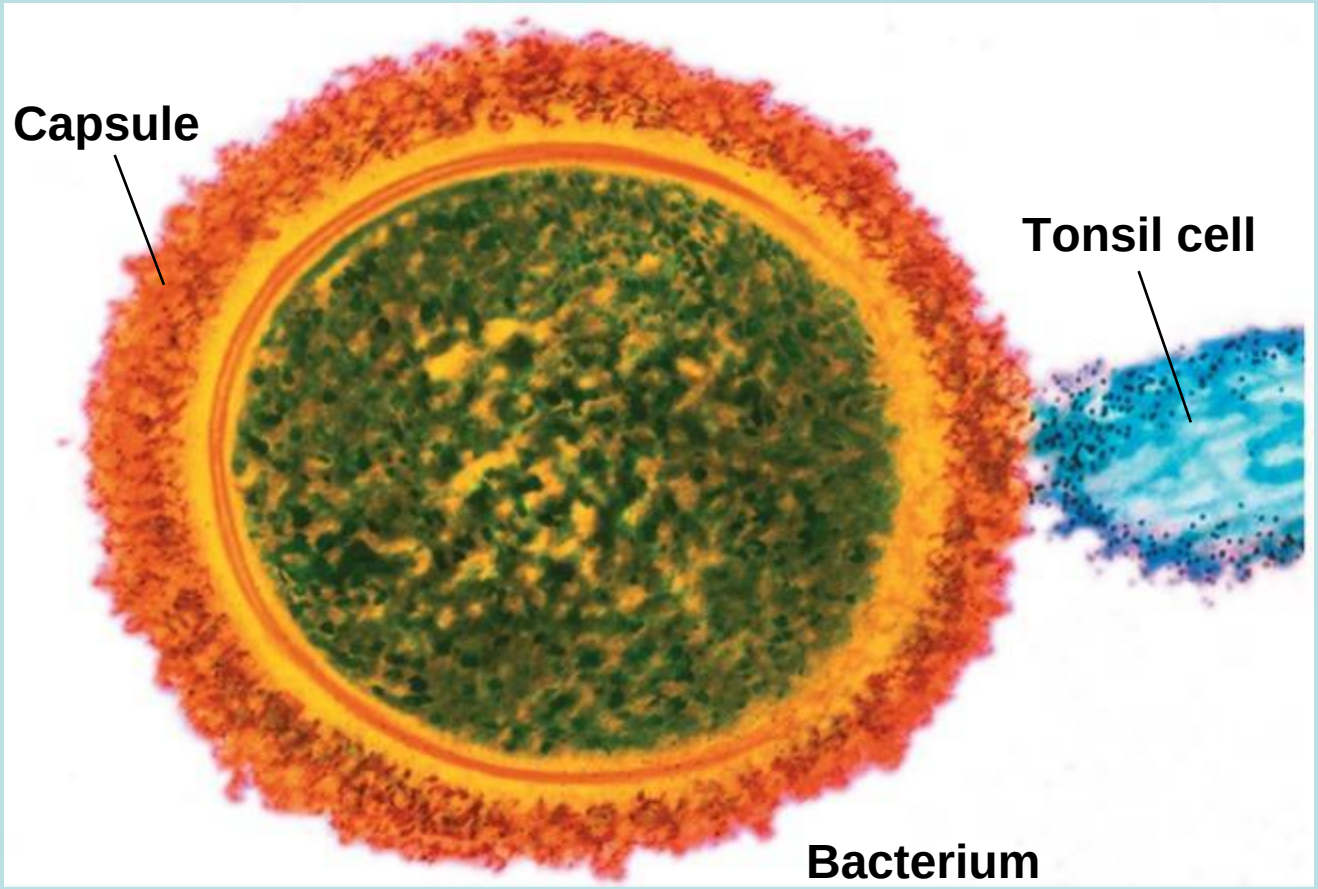


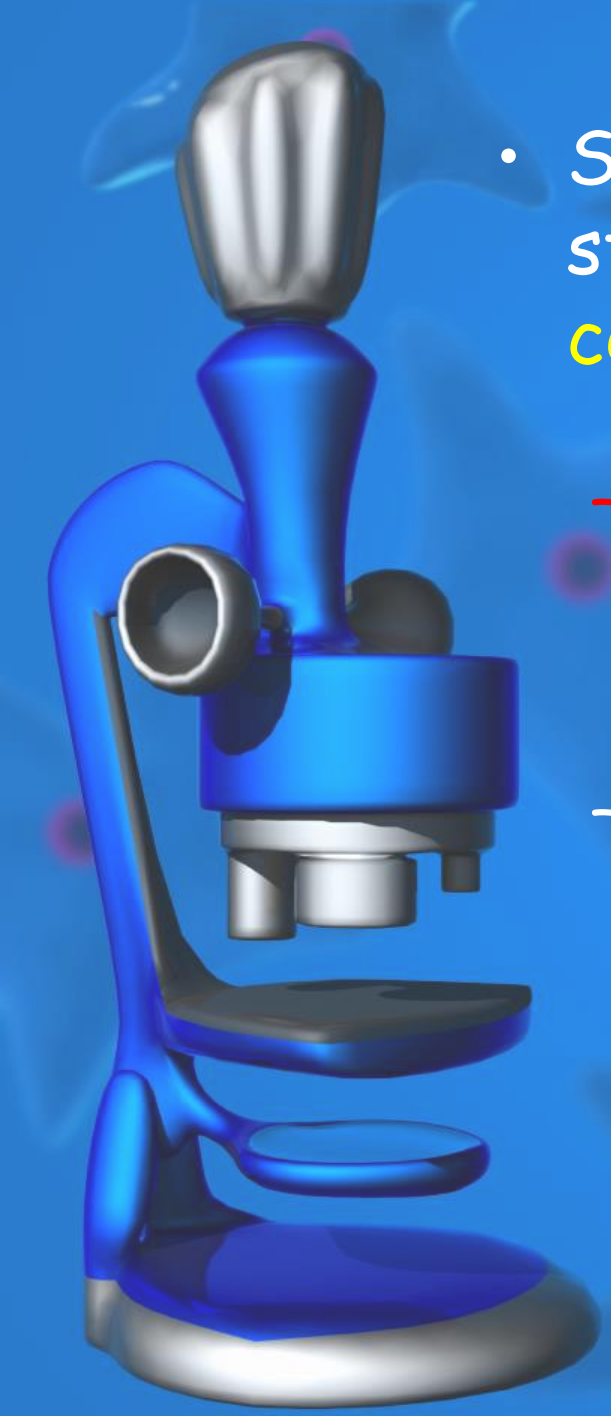
Gram Negative



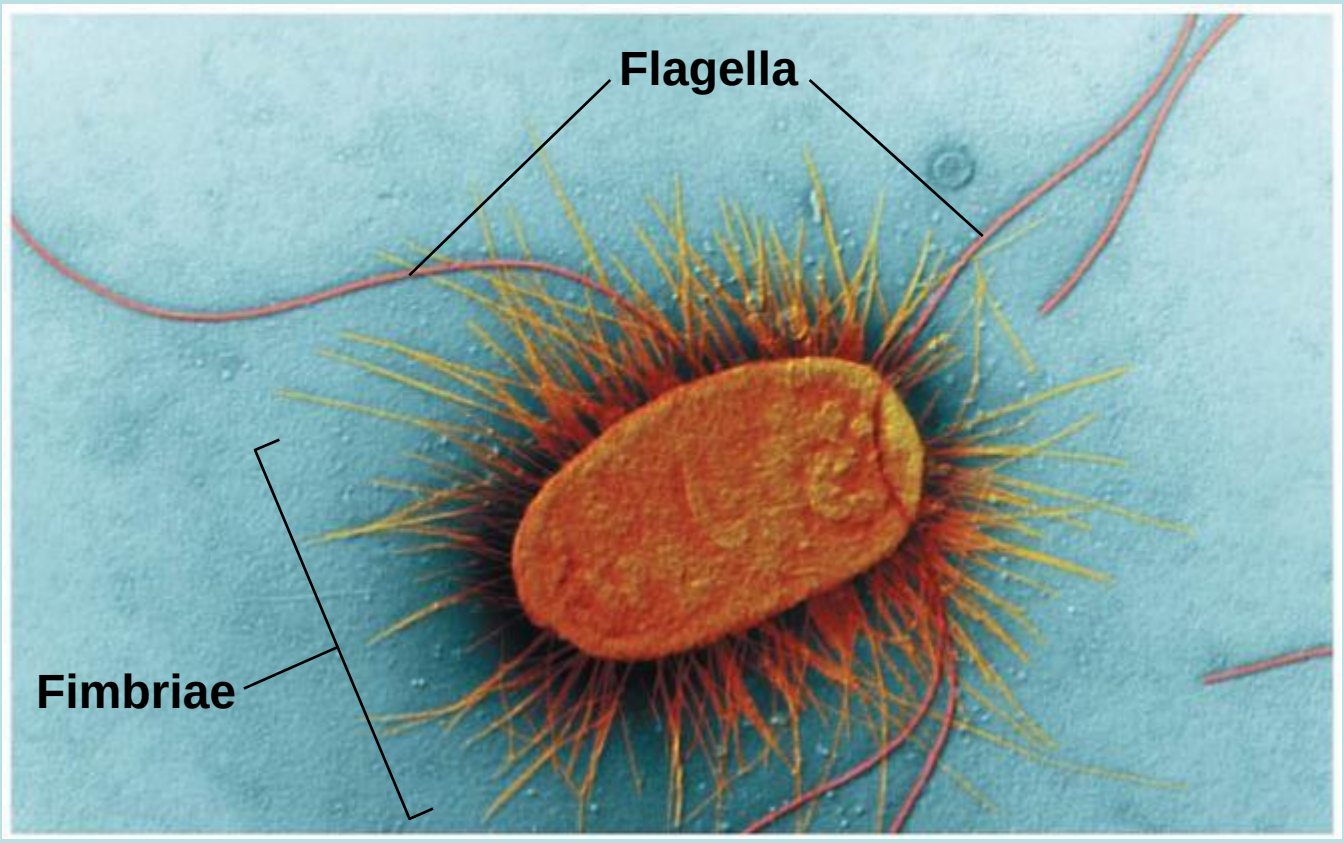
- The **Cell Wall** of many prokaryotes is covered by a **CAPSULE**, a sticky layer of sugars or proteins.

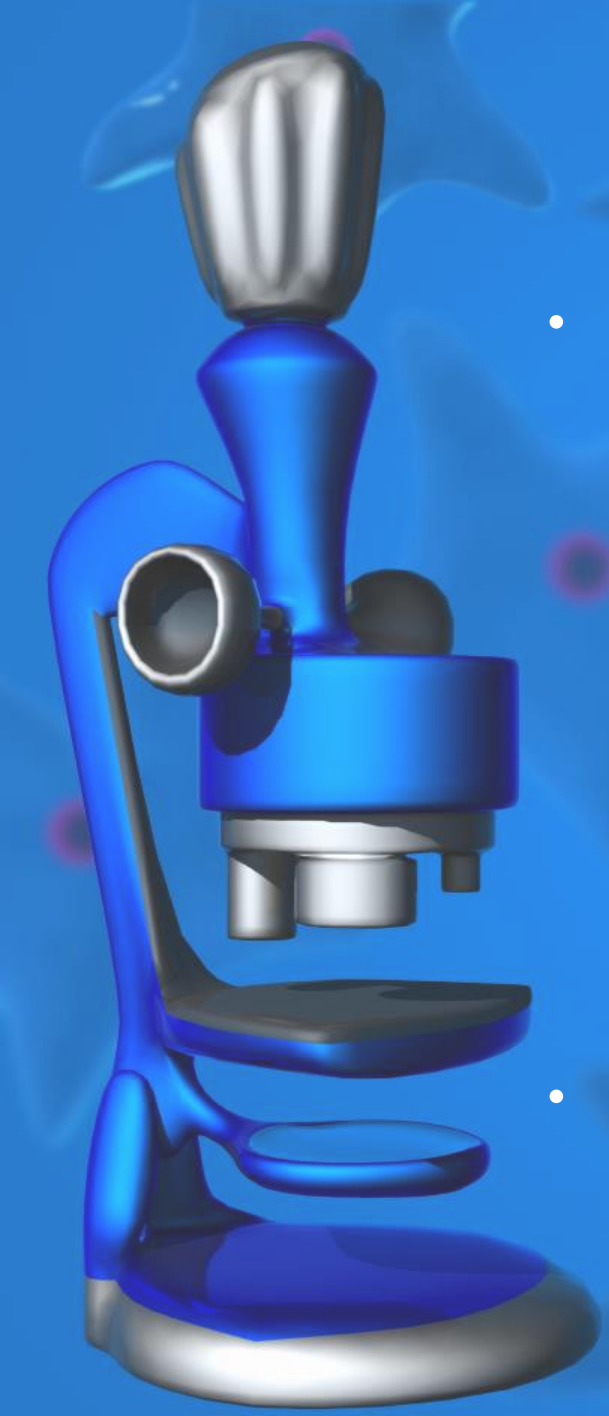
- The **CAPSULE**:
  - enables prokaryotes to adhere to their substrate.
  - shields pathogenic prokaryotes from attacks by their host's immune system.


Capsule
Tonsil cell
Bacterium



- Some prokaryotes have external structures that extend beyond the cell wall:
  - FLAGELLA are adaptations that enable them to move about in response to signals in their environment.
  - Hair-like projections called FIMBRIAE enable prokaryotes to
    - stick to a surface or each other
    - latch onto the host cells they colonize.


Flagella
Fimbriae

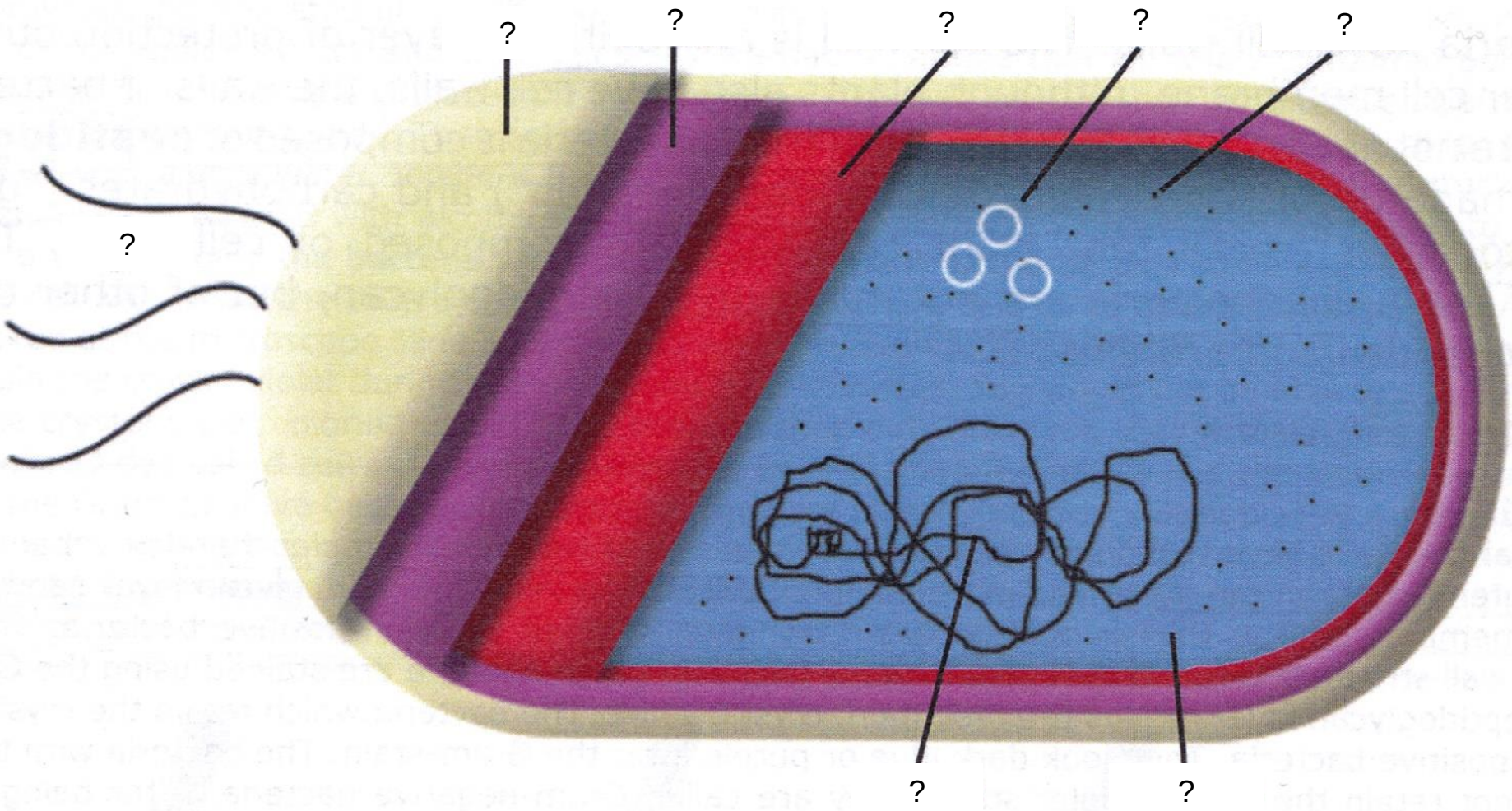


Prokaryotic Genome

- The **Genome of a Prokaryote** typically
  - has about one-thousandth as much DNA as a eukaryotic genome
  - is **ONE LONG, CIRCULAR CHROMOSOME** packed into a distinct region of the cell: **Nucleoid Region**
- Many prokaryotes also have **additional small, circular DNA molecules** called **PLASMIDS**, which **replicate independently of the chromosome**.

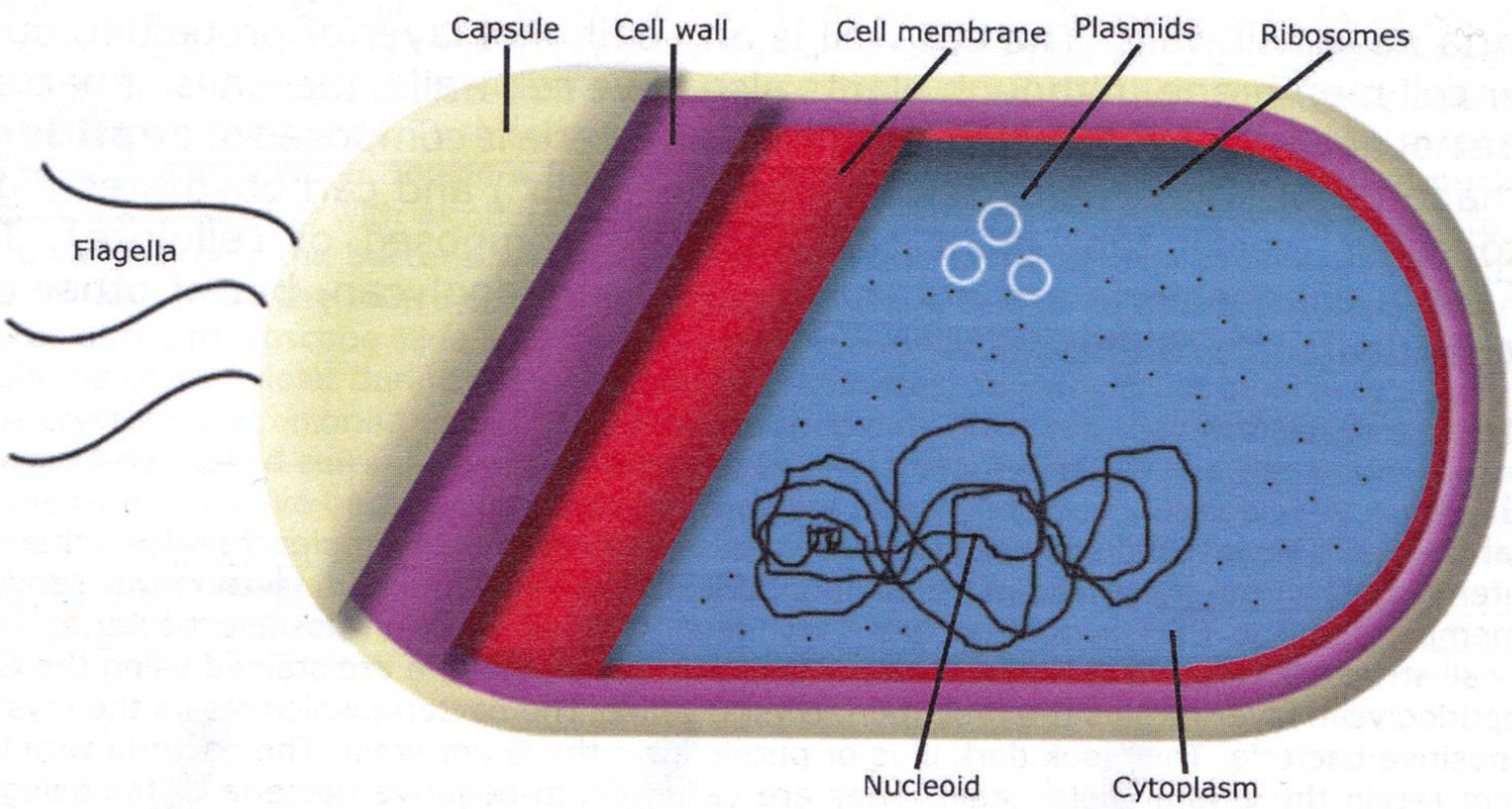
TRY IT

Bacterial Structure



TRY IT

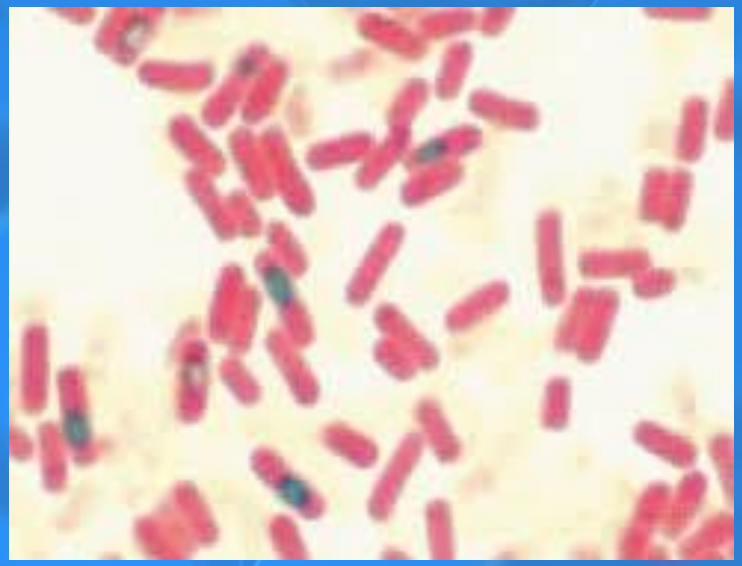
Bacterial Structure



Prokaryotes can adapt rapidly to changes in the environment

- Some prokaryotes form specialized cells called **ENDOSPORES** that remain dormant through harsh conditions.
- **Endospores** can survive extreme heat or cold.
- When the endospore receives environmental cues that conditions have improved, it
  - absorbs water and
  - resumes growth.

Endospores



Prokaryotes have unparalleled Nutritional Diversity

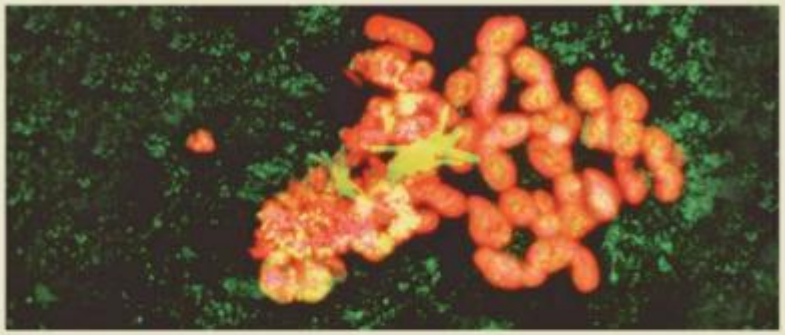
- **Prokaryotes** exhibit much more nutritional diversity than eukaryotes, allowing them to inhabit almost every nook and cranny on Earth.
- Two sources of **Energy** are used.
  1. ***Phototrophs*** capture energy from sunlight.
  2. ***Chemotrophs*** harness the energy stored in chemicals, organic or inorganic (Sulfur, Ammonia, etc.)

Prokaryotes have unparalleled Nutritional Diversity

- Two sources of **Carbon** are used by prokaryotes.
  - ***Autotrophs*** obtain carbon atoms from carbon dioxide.
  - ***Heterotrophs*** obtain their carbon atoms from the organic compounds present in other organisms.

Prokaryotes have unparalleled Nutritional Diversity

- The terms that describe how prokaryotes obtain **Energy and Carbon** are combined to describe their modes of nutrition:
  - **Photoautotrophs** harness **sunlight** for energy and use **CO_2** for carbon.
  - **Photoheterotrophs** obtain energy from **sunlight** but get their carbon atoms from **organic sources**.
  - **Chemoautotrophs** harvest energy from **inorganic chemicals** and use carbon from **CO_2** to make organic molecules.
  - **Chemoheterotrophs** acquire energy and carbon from **organic molecules** ; **Largest and most diverse group of Prokaryotes.**

		Energy source: Sunlight	Energy source: Chemicals
Carbon source: CO_2		**Photoautotrophs**  *Oscillatoria*	**Chemoautotrophs**  Unidentified “rock-eating” bacteria
Carbon source: Organic compounds		**Photoheterotrophs**  *Rhodopseudomonas*	**Chemoheterotrophs**  *Salmonella typhimurium*

Bacteria and Archaea are the Two Main Branches of Prokaryotic Organisms

Studies of representative genomes of prokaryotes and eukaryotes strongly support the **Three-Domain** view of life.

- **Eukaryotes** belong to the domain **EUKARYA**.
- **Prokaryotes** are now classified into two domains:
  1. **Eubacteria**
  2. **ArchaeaBacteria**

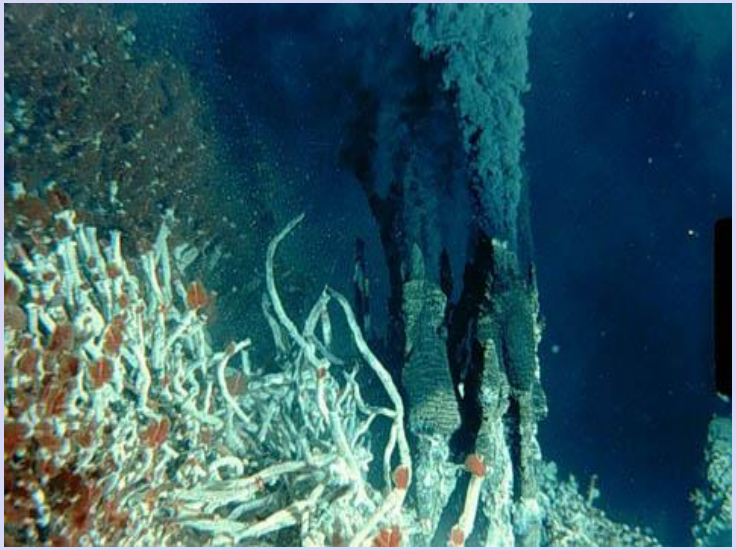
Archaea thrive in Extreme Environments — and in other habitats

- **Archaea** inhabitants of extreme environments have unusual proteins and other molecular adaptations that enable them to metabolize and reproduce effectively.
  - ***Extreme Halophiles*** thrive in very **salty places**.
  - ***Extreme Thermophiles*** thrive in **very hot water**, such as geysers.

Archaea thrive in Extreme Environments—and in other habitats

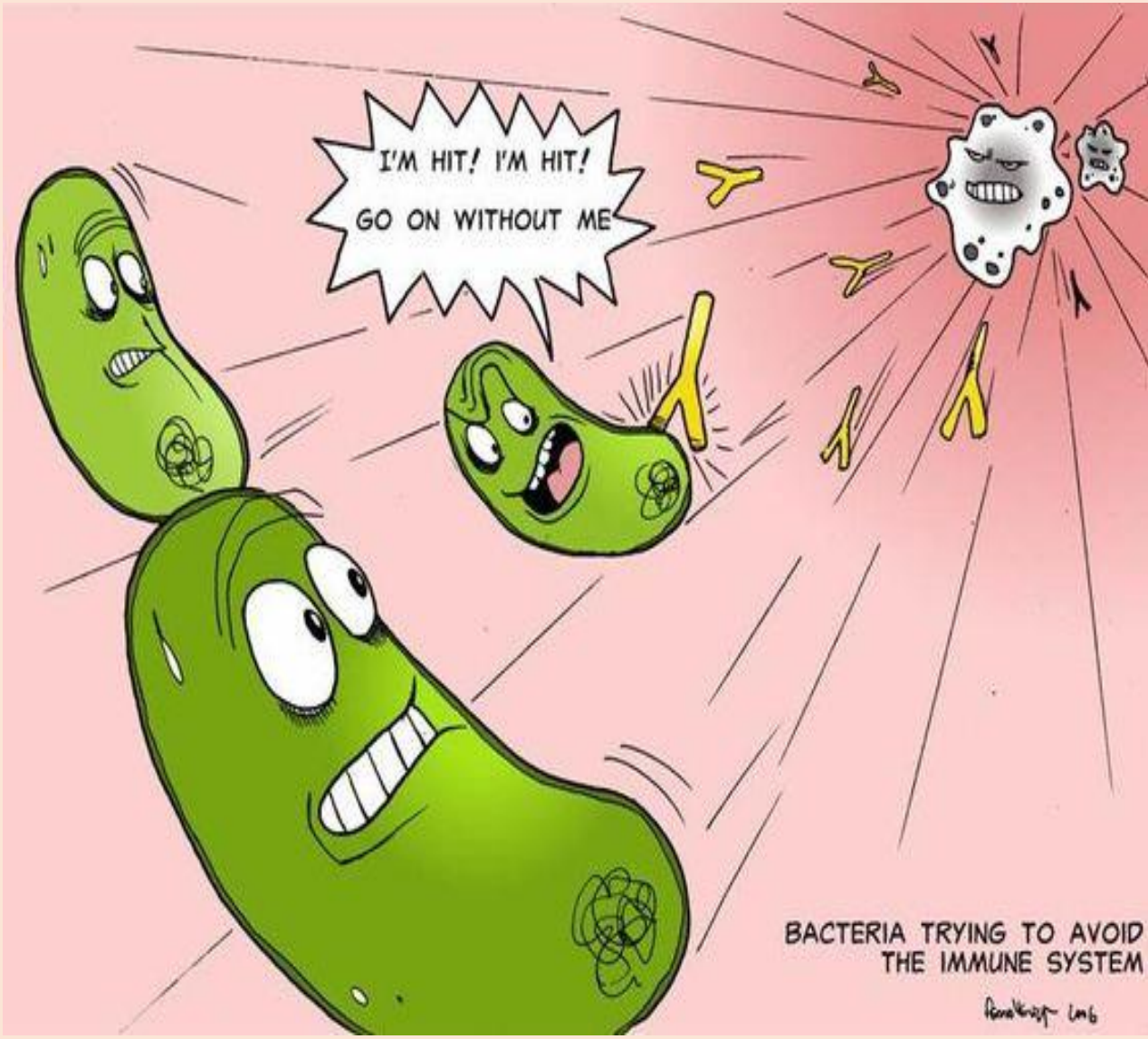
- ***Methanogens***
  - live in **anaerobic environments**
  - give off **methane** as a waste product from
    - the digestive tracts of cattle and deer
    - decomposing materials in landfills

Archaebacteria



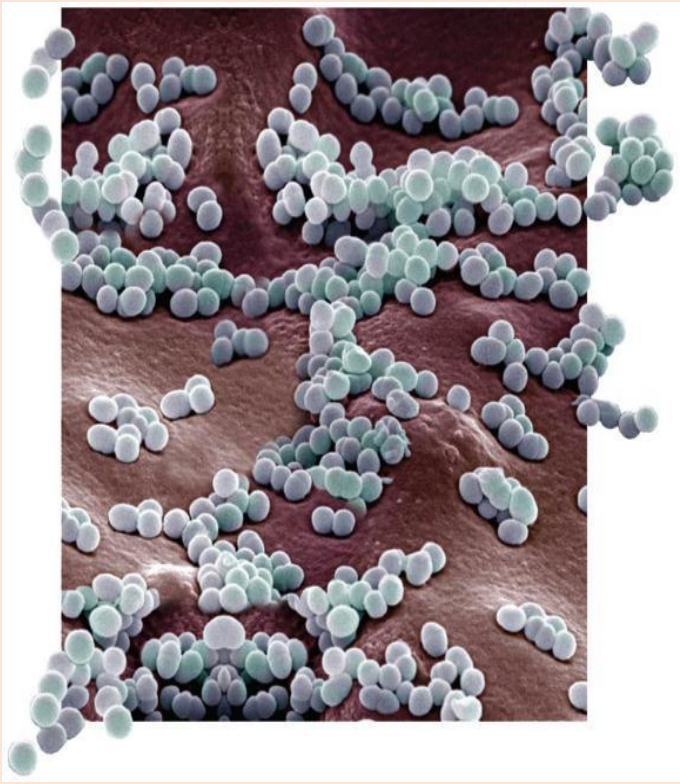
Some Bacteria Cause Disease

- All organisms are almost constantly exposed to **Pathogenic Bacteria**.
- Most often, our **body's defenses** prevent pathogens from affecting us.



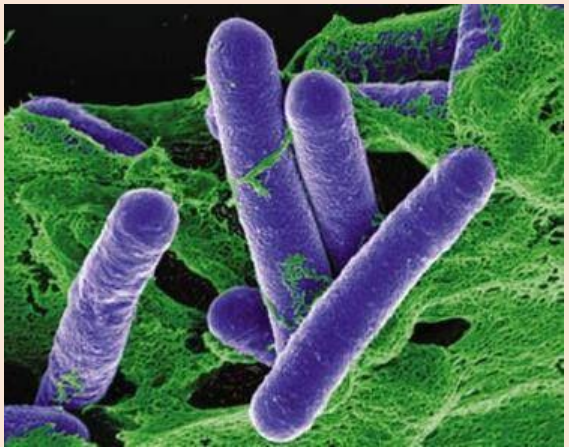
Some Bacteria Cause Disease

- Most bacteria that cause illness do so by producing a **Toxin** (poison).
  - **Exotoxins** are proteins that bacterial cells secrete into their environment.
  - Examples
    - Bacteria that produce diphtheria or tetanus



Some Bacteria Cause Disease

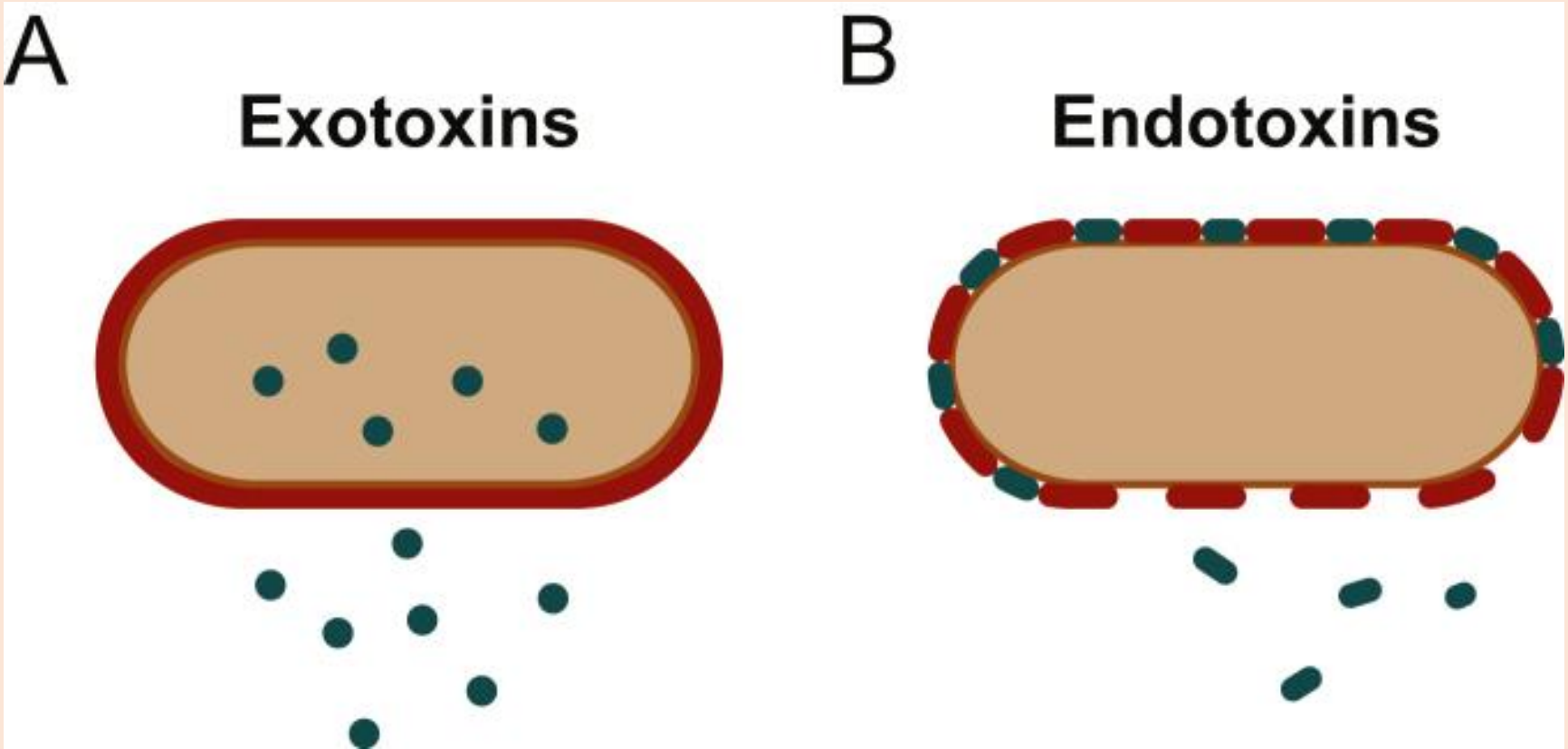
- **Endotoxins** are components of the cell wall of gram-negative bacteria that are released when the cell dies.
- All endotoxins induce the same general symptoms: fever, aches, and sometimes a dangerous drop in blood pressure.
- Examples:
  - Bacteria that produce Typhoid Fever or Meningitis



Endotoxins cause Gram-negative sepsis.

Exotoxins are mostly secreted by Gram-positive bacteria.

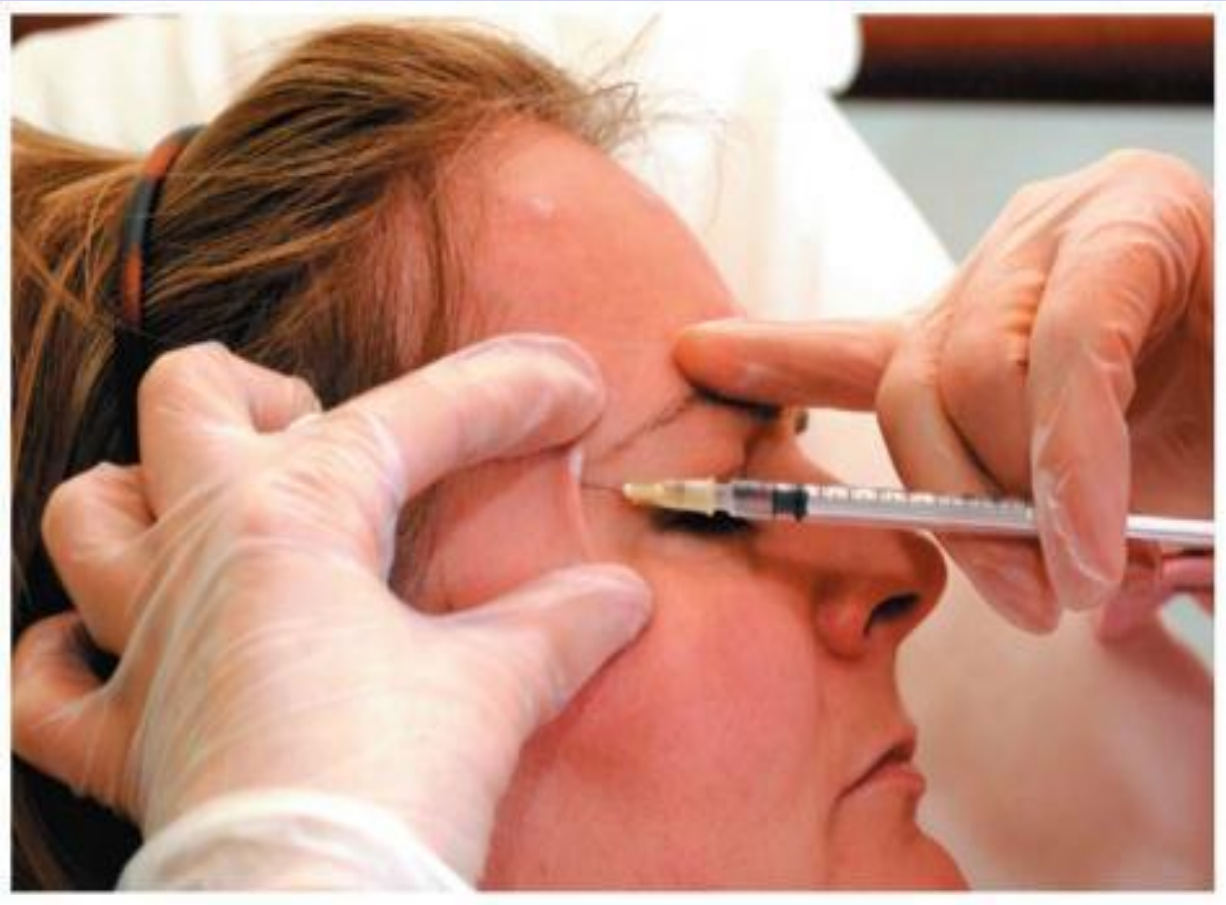
While endotoxins are membrane compounds of Gram-negative bacteria which elicit an inflammatory response in host, exotoxins are secreted proteins which act locally and at distance of the bacterial colonization site.



Some Bacteria Cause Disease

- The weapon form of ***Clostridium botulinum*** is the **exotoxin** it produces, **Botulinum**, which is the deadliest poison known.
- **Botulinum** blocks transmission of the nerve signals that cause muscle contraction, resulting in **paralysis of the muscles required for breathing**.

This effect is also responsible for a more benign use of **botulinum**— relaxing facial muscles that cause wrinkles.



Human Uses For Bacteria

Bacteria are used to produce a wide variety of foods and beverages.

Examples: sour cream, yogurt, cheese.

Some bacteria can digest oil and are helpful in cleaning up oil spills.

Bacteria can Transfer DNA in Three Ways

- Bacteria are very valuable as microbial models in **genetics research**:
  - Most of a bacterium's DNA is found in a **single, closed-loop chromosome**.
  - Bacterial cells divide by replication of the bacterial chromosome and then by **binary fission**.
  - Because binary fission is an asexual process, bacteria in a colony are genetically identical to the parent cell.

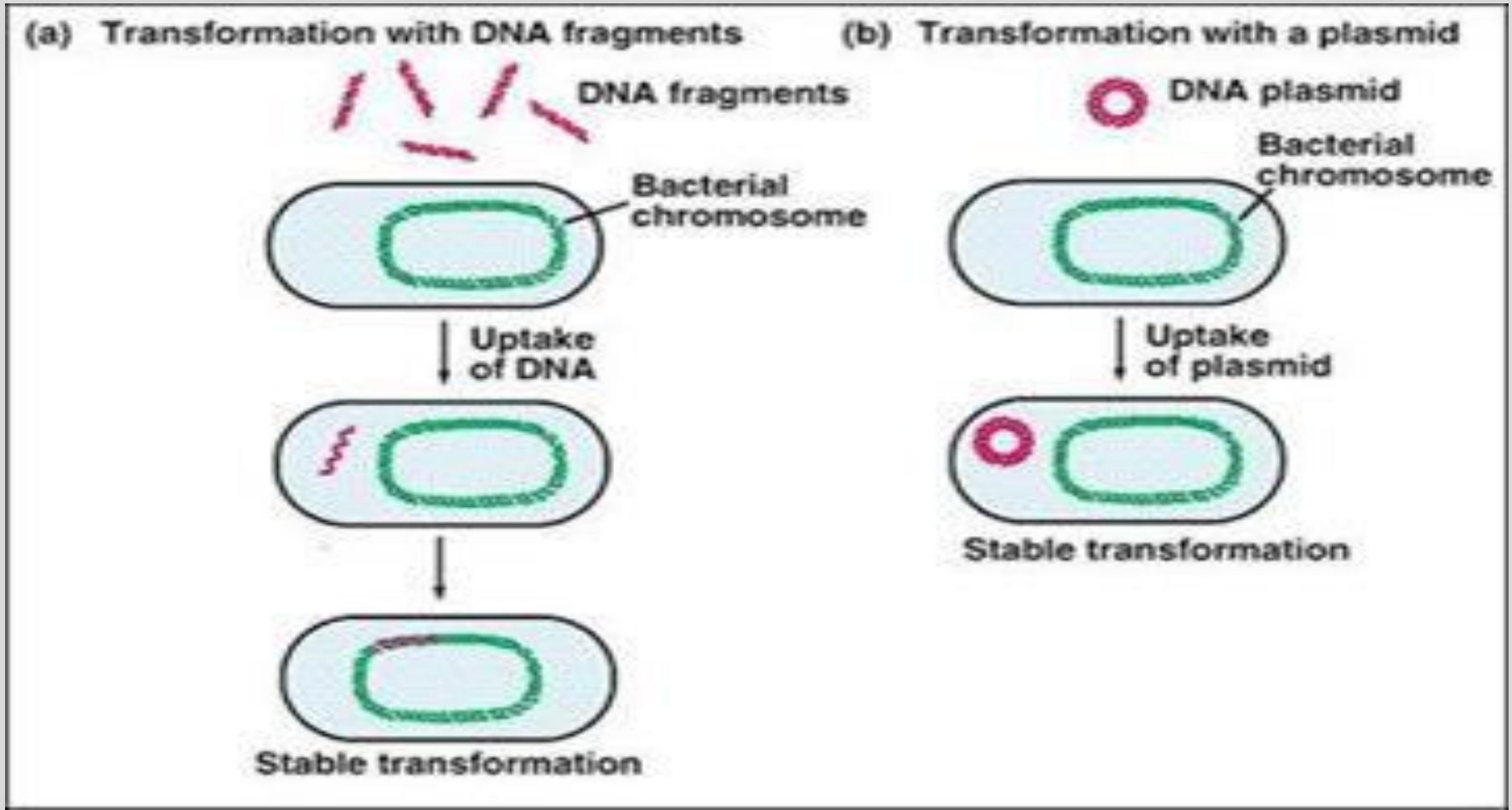
Bacteria can Transfer DNA in Three Ways

Bacteria use **three mechanisms** to **move genes from cell to cell**.

1. ***Transformation*** is the uptake of DNA from the surrounding environment.
2. ***Transduction*** is gene transfer by bacteriophages.
3. ***Conjugation*** is the transfer of DNA from a donor to a recipient bacterial cell.

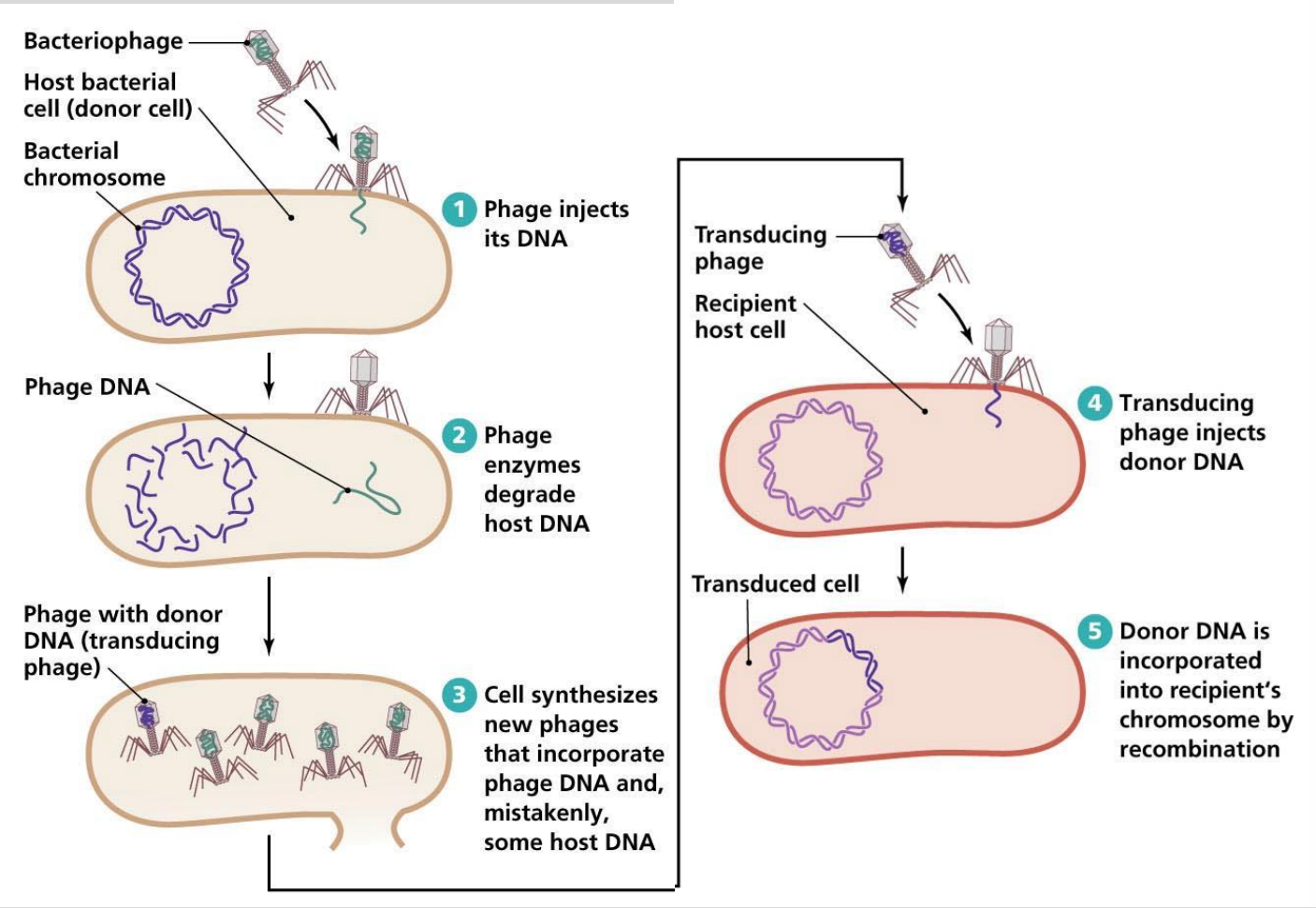
Bacteria can Transfer DNA in Three Ways

- ***Transformation*** is the uptake of DNA from the surrounding environment.



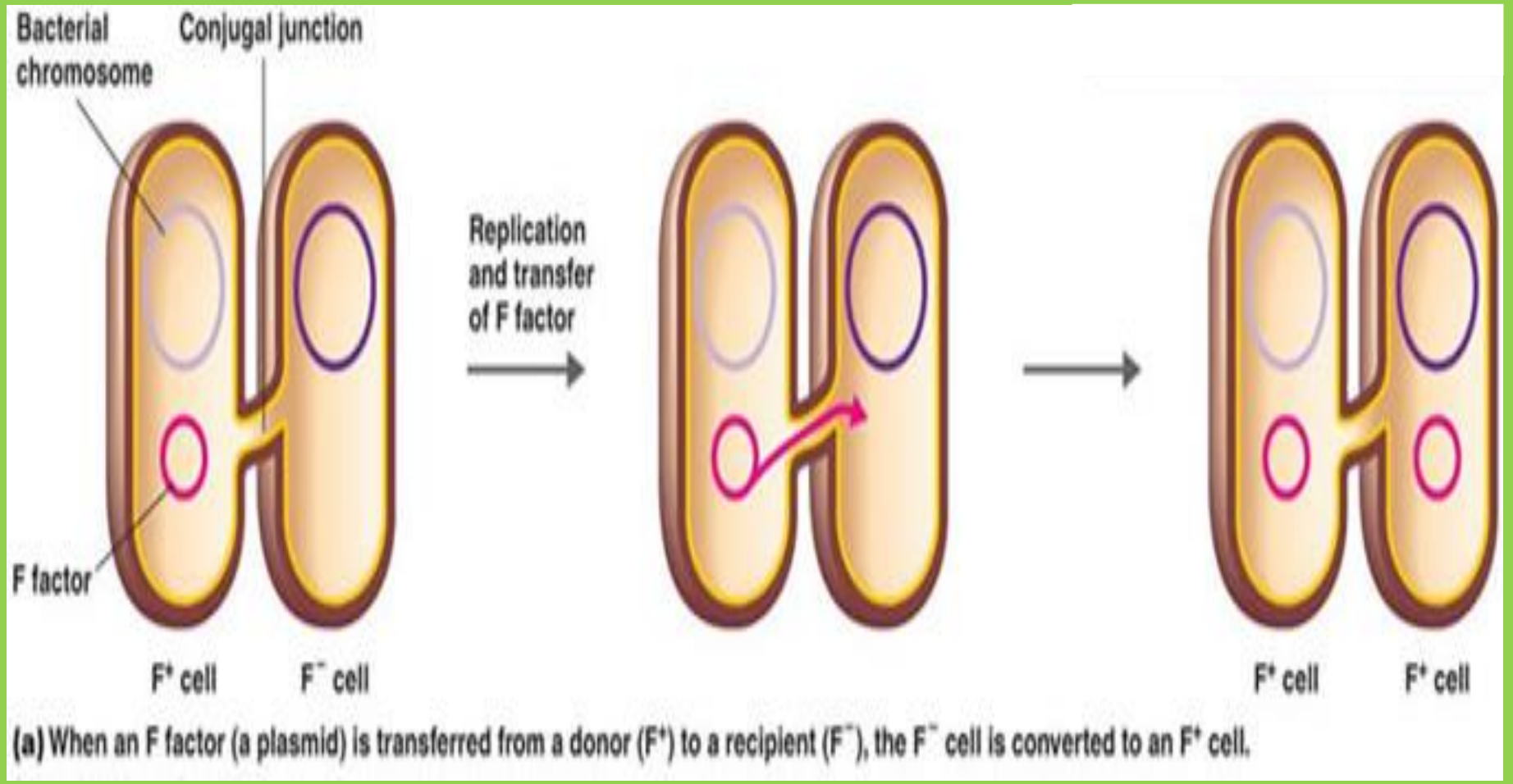
Bacteria can Transfer DNA in Three Ways

- ***Transduction*** is gene transfer by bacteriophages



Bacteria can Transfer DNA in Three Ways

- ***Conjugation*** is the transfer of DNA from a donor to a recipient bacterial cell.



Antibiotics

Antibiotics are compounds that: kill bacteria.

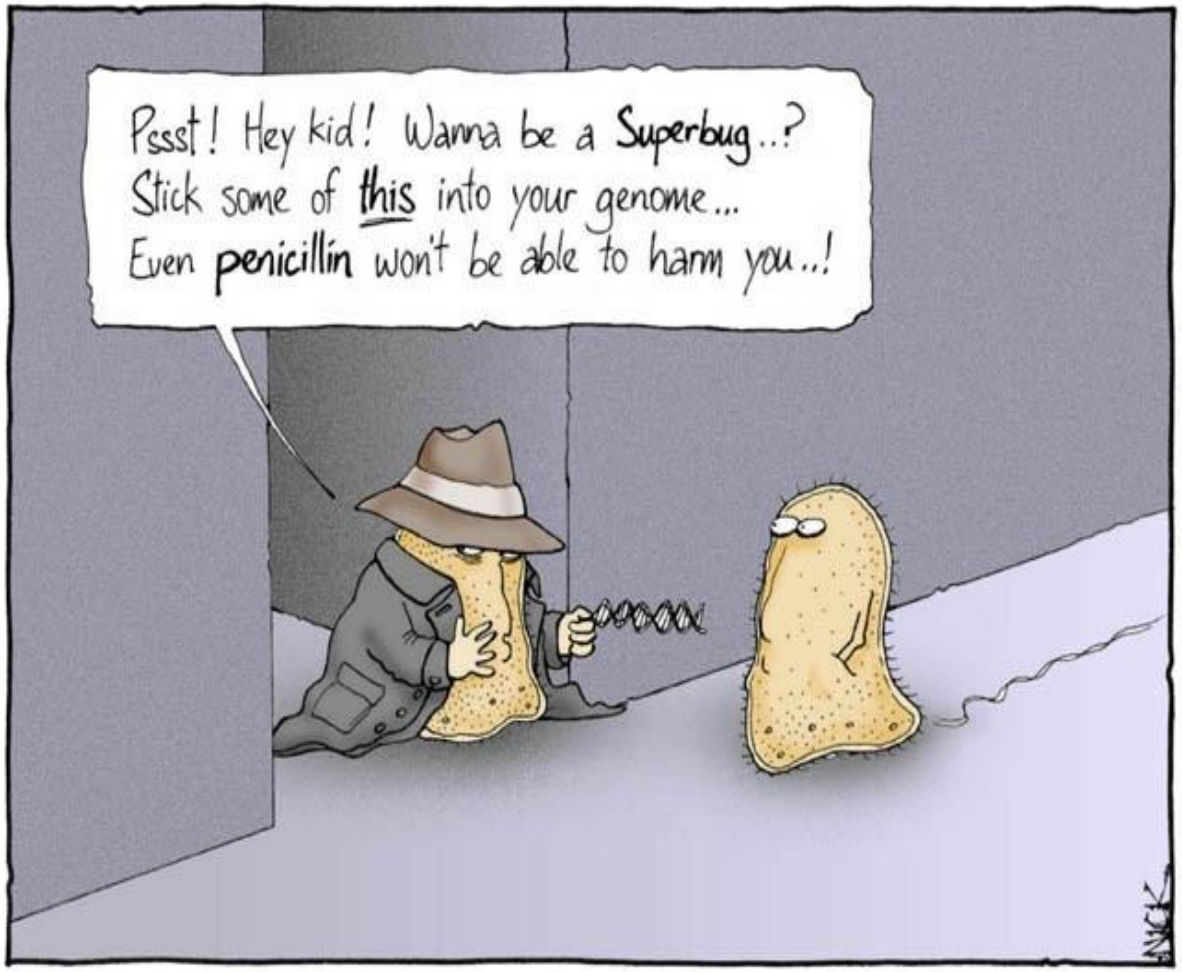
They are effective against bacteria, but have no effect on viruses.

How do Antibiotics Work?

- They work to inhibit a bacterial function that the host does not perform.
- That way they are able to kill the bacteria and not harm the host.
- Some antibiotics work by inhibiting the bacteria's ability to make the cell wall (penicillin, cephalosporin).

How do Antibiotics Work?

Antibiotic Resistance: Most occur by bacteria acquiring resistance plasmids



It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.