

# Diversity of Living Things

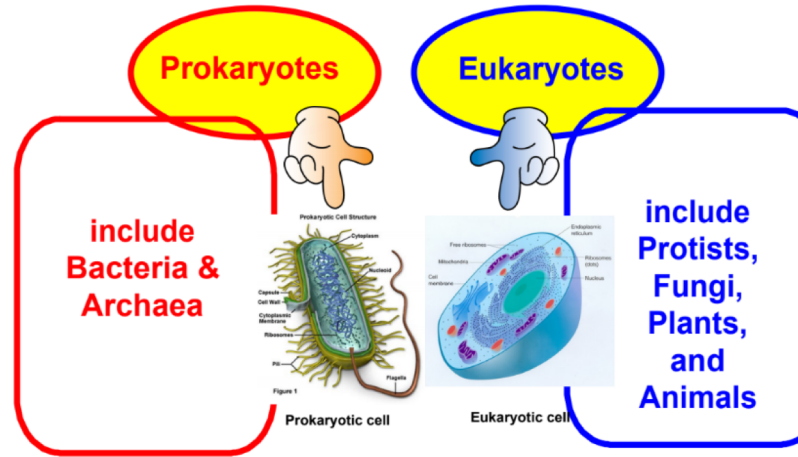
## Lesson 3: Eukaryotes and Prokaryotes Kingdoms and Domains

### List of the 3 Domains & 6 Kingdoms

Domain Archaea	Domain Bacteria	Domain Eukarya
Kingdom Archaeobacteria	Kingdom Eubacteria	Kingdom Protista
		Kingdom Fungi
		Kingdom Plantae
		Kingdom Animalia

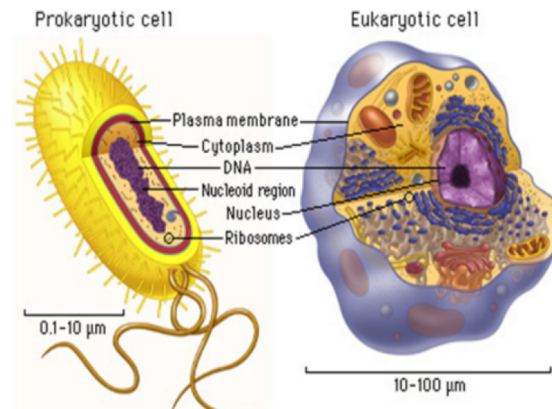
## Prokaryotes and Eukaryotes

- These are 2 basic cell types based on differences in size, structure, and other characteristics

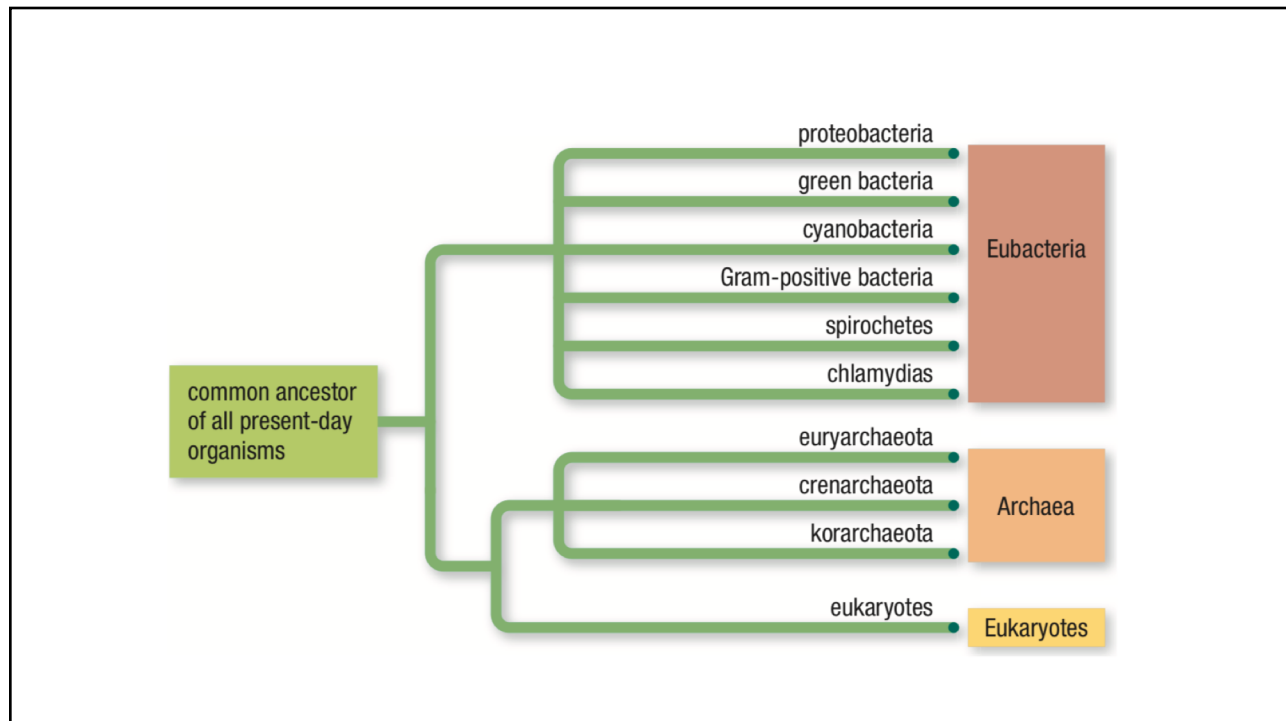


## So What's The Difference??

PROKARYOTES	EUKARYOTES
means "before nucleus"	means "true nucleus"
small & single celled	Complex cells
DNA in nuclear region (not bound by nuclear membrane)	DNA in a membrane-bound nucleus
No organelles, except ribosomes	Many membrane-bound organelles



The micrometre (International spelling as used by the International Bureau of Weights and Measures; [1] SI symbol:  $\mu\text{m}$ ) or micrometer (American spelling), also commonly known as a micron, is an SI derived unit of length equaling  $1 \times 10^{-6}$  of a metre (SI standard prefix "micro-" =  $10^{-6}$ ); that is, one millionth of a metre (or one thousandth of a millimetre, 0.001 mm, or about 0.000039 inch). [1]

**Table 1** Key Features of the Six Major Groups of Bacteria

Group	Key features
proteobacteria (purple bacteria)	<ul style="list-style-type: none"> <li>Some are photosynthetic but use a form of photosynthesis that differs from that of plants.</li> <li>Ancient forms of these bacteria were the likely ancestors of eukaryotic mitochondria.</li> <li>Some are nitrogen fixing.</li> <li>They are responsible for many diseases, including bubonic plague, gonorrhea, dysentery, and some ulcers.</li> </ul>
green bacteria	<ul style="list-style-type: none"> <li>They use a form of photosynthesis that differs from that of plants.</li> <li>They are usually found in salt-water environments or hot springs.</li> </ul>
cyanobacteria (blue-green algae)	<ul style="list-style-type: none"> <li>They use a form of photosynthesis similar to plants and other eukaryotes.</li> <li>Ancient forms of these bacteria were the likely ancestors of eukaryotic chloroplasts.</li> <li>They play major roles as producers and nitrogen fixers in aquatic ecosystems.</li> <li>They form symbiotic relationships with fungi.</li> </ul>
Gram-positive bacteria	<ul style="list-style-type: none"> <li>They cause many diseases, including anthrax, strep throat, bacterial pneumonia, and meningitis.</li> <li>They are used in food production (for example, lactobacillus is used in yogurt and probiotic products).</li> <li>Some have lost their cell wall.</li> <li>One type—mycoplasmas—are the smallest known cells (0.1 <math>\mu\text{m}</math> to 0.2 <math>\mu\text{m}</math>).</li> </ul>
spirochetes	<ul style="list-style-type: none"> <li>Their spiral-shaped flagellum is embedded in their cytoplasm.</li> <li>They move with a corkscrew motion.</li> <li>They cause syphilis.</li> <li>Symbiotic spirochetes in termite intestines digest wood fibre.</li> </ul>
chlamydias	<ul style="list-style-type: none"> <li>All are parasites that live within other cells.</li> <li>They cause chlamydia, one of the most common sexually transmitted infections.</li> <li>They cause trachoma, the leading cause of blindness in humans.</li> </ul>

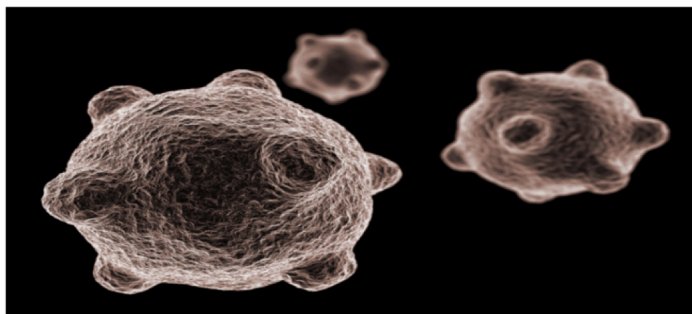
## •Questions:

1. What are 2 similarities / 2 differences between Prokaryotic and Eukaryotic cells?

2. I am 50um in size, divide by mitosis, and have mitochondria...

I am a \_\_\_\_\_ cell.

## Kingdom Bacteria



- Bacteria are Prokaryotes
- They live as single cells, therefore unicellular
- Their preferred method of reproduction is asexual reproduction by binary fission



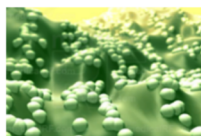
- Majority of bacteria are bad
- Such as bacteria that causes Tuberculosis
- Lyme disease (infectious disease caused by bacteria of the Borrelia type which is spread by ticks; at the site of a tick bite, skin will be expanding and showing redness)
- Plaque on teeth
- Pimple on face
- But some of bacteria are good
- Such as yogurt (use bacteria as starter cultures to ferment lactose to produce lactic acid)
- And bacteria in human beings' gut to assist digestion (symbiotic)
- The fact: Bacteria is made up of 10% of human beings' body mass
- Antibiotics (kill bacteria): discovery of Penicillin (fungi) by Alexander Fleming on 1928.



# Classifying bacteria

## 1. Shape

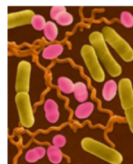
- **Cocci**, or round (singular coccus)
- **Bacilli**, or rod-shaped (singular bacillus)
- **Spirilli**, or spiral-shaped (singular spirillum)



cocci



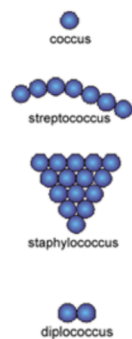
bacilli

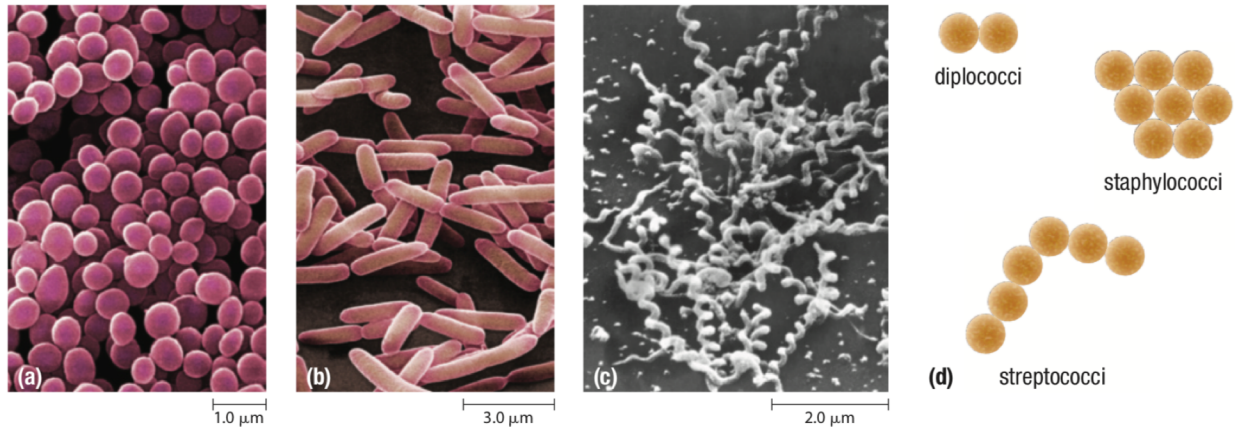


spirilli

## 2. Arrangement

- **diplo** describes bacteria cells arranged in pairs
- **staphylo** describes bacteria cells arranged in clusters
- **strepto** refers to bacteria cells arranged in a chain





**Figure 7** Bacteria cells have three common shapes: (a) cocci, (b) bacilli, and (c) spirilla. (d) They often occur in pairs (diplo), clumps (staphylo), or strings (strepto).

# Classifying bacteria

Gram Stain: Method of staining to distinguish and classify bacteria

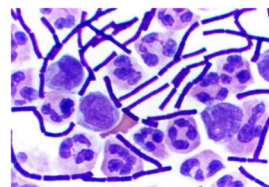
## 3. Cell Wall Structure

- Gram stain is used to highlight differences in the arrangements of amino acid and sugar molecules in bacterial cell walls

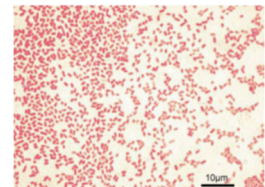
Peptidoglycan

Gram-positive bacteria have a **thick** protein layer on their cell wall and stain **purple**.

Gram-negative bacteria have a **thin** protein layer on their cell walls and stain **pink**.



**gram positive**  
(usually less pathogenic and shorter term ailments, but some forms can lead to deadly situations)



**gram negative**  
(larger in number and more diverse species and usually longer term ailments causing longterm diseases)

**Video 1:** gram + vs gram -  
<https://www.youtube.com/watch?v=hj2c8fZWIM>

# Classifying bacteria

## 4. Nutrition/Energy Source

- Most are heterotrophs (obtain energy from consuming other organisms)
- i) parasites (absorb nutrients from other living organisms)

OR

- Others are autotrophs/phototrophs (make their own food using sunlight via photosynthesis)

Read Textbook, get more information about this

# Classifying bacteria

## 5. Bacterial Reproduction

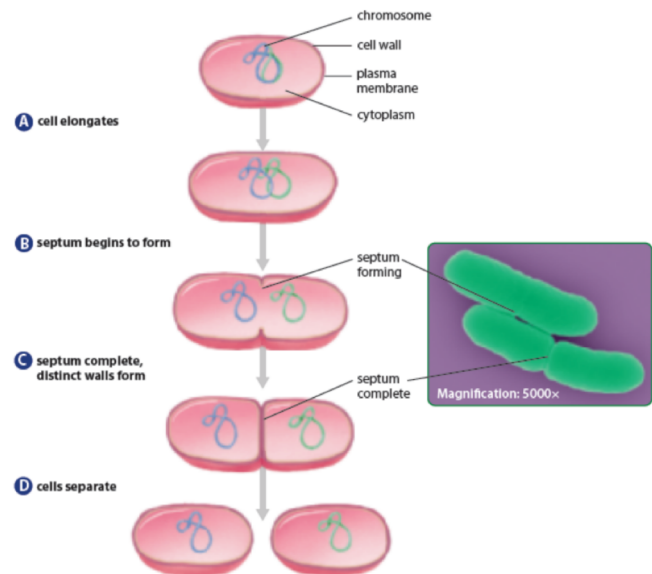
### i. Asexual Reproduction

- Bacteria lack a nucleus, therefore, they cannot reproduce by mitosis or meiosis
- Their genetic material is contained in a single chromosome within the cell

# Asexual reproduction

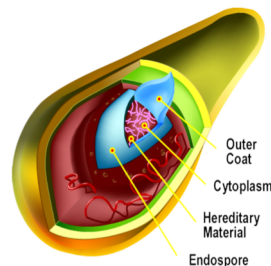
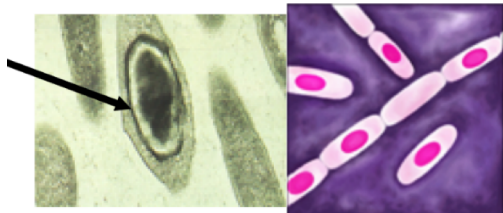
## Steps to Binary Fission:

1. As a bacterial cell grows, it makes a copy of its original, single chromosome. The cell elongates and separates the two chromosomes.
2. A septum (partition) begins to form and separates the elongated cell.
3. When the septum is complete, distinct cell membranes/walls form.
4. The cells separate into 2 smaller, genetically identical cells.
5. Natural form of cloning in nature.



# Asexual reproduction

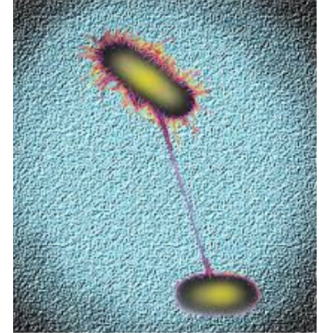
- Under harsh environment, bacteria stop doing reproduction, instead, they prefer entering dormant phase by developing a tough outer covering that surrounds their DNA, called an endospore.



- While in the endospore stage, bacteria do not grow or reproduce, and can withstand harsh conditions.
- When conditions become more favorable, the endospore loses its coat and begins to grow and divide like a normal cell.

# Sexual reproduction

- Occurs when conditions are unfavorable so bacteria have to adapt to change
- The occurring of **conjugation** results in new cells with new genetic combinations. (Mutations or new genetic arrangement can become resistant or tolerant to outer environment)
- 1. Bacterial cells become linked or connected to one another through a bridge-like structure called a **pilus**, and then they exchange/transfer part of or all of their chromosomes/plasmids
- 2. Then... the bacteria cells separate and continue normal reproduction by themselves through Binary Fission
- 3. The only reason why Conjugation is classified as a form of sexual reproduction is because of the exchange of DNA and therefore genetic diversity increases.



## Summary:

1. 3 Domains and 6 Kingdoms
2. Differences and similarities between Prokaryotes and Eukaryotes
3. Classification of Bacteria
  - Shape (cocci - round, bacilli - rod, spirilla - spiral)
  - Arrangement (diplo - pair, staphylo - cluster, strepto - string)
  - Cell wall structure (gram + and gram -)
  - Nutrients and energy source
  - Reproduction
    - (asexual – binary fission and endospore, sexual – conjugation)