BACTERIOLOGY

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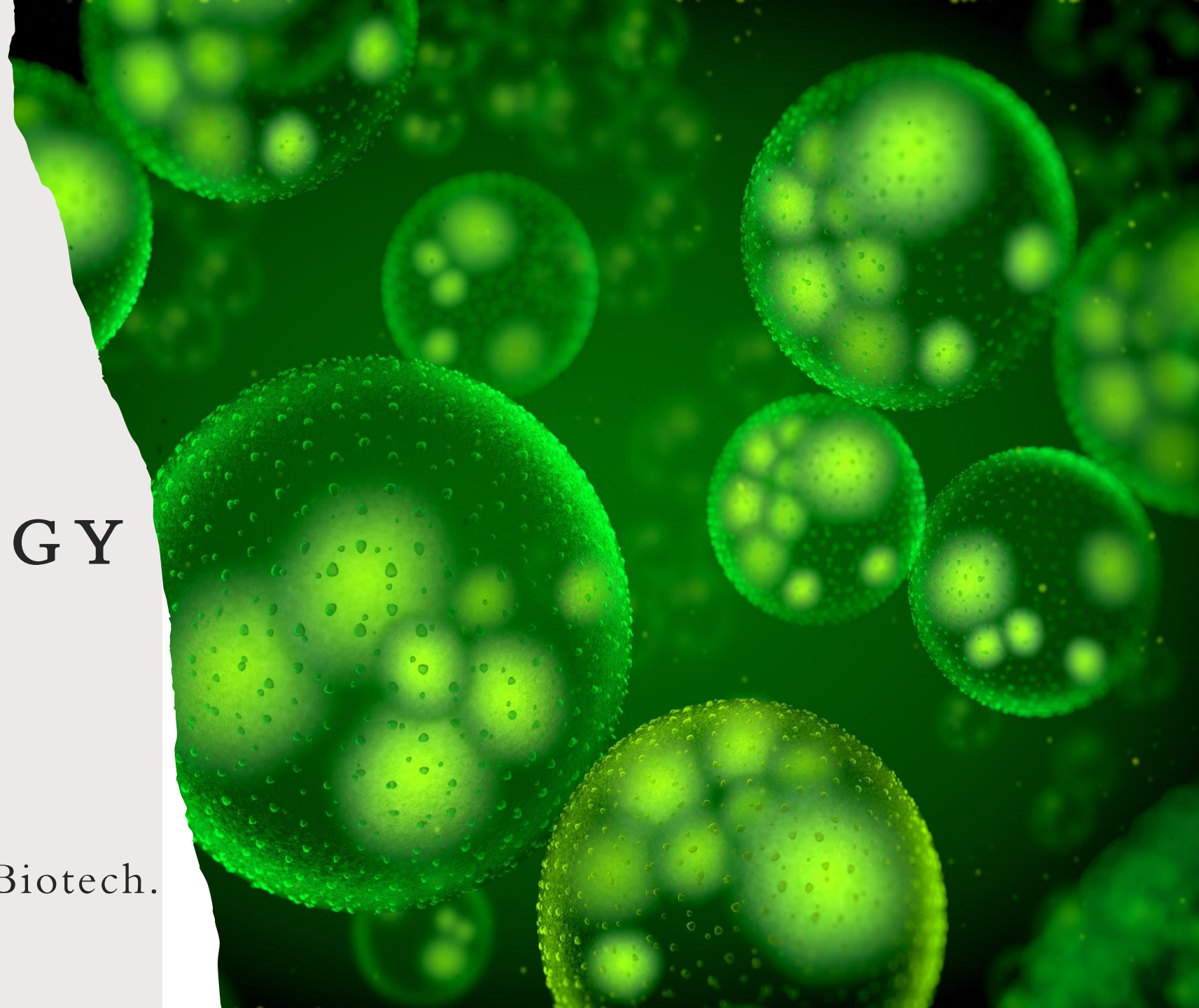
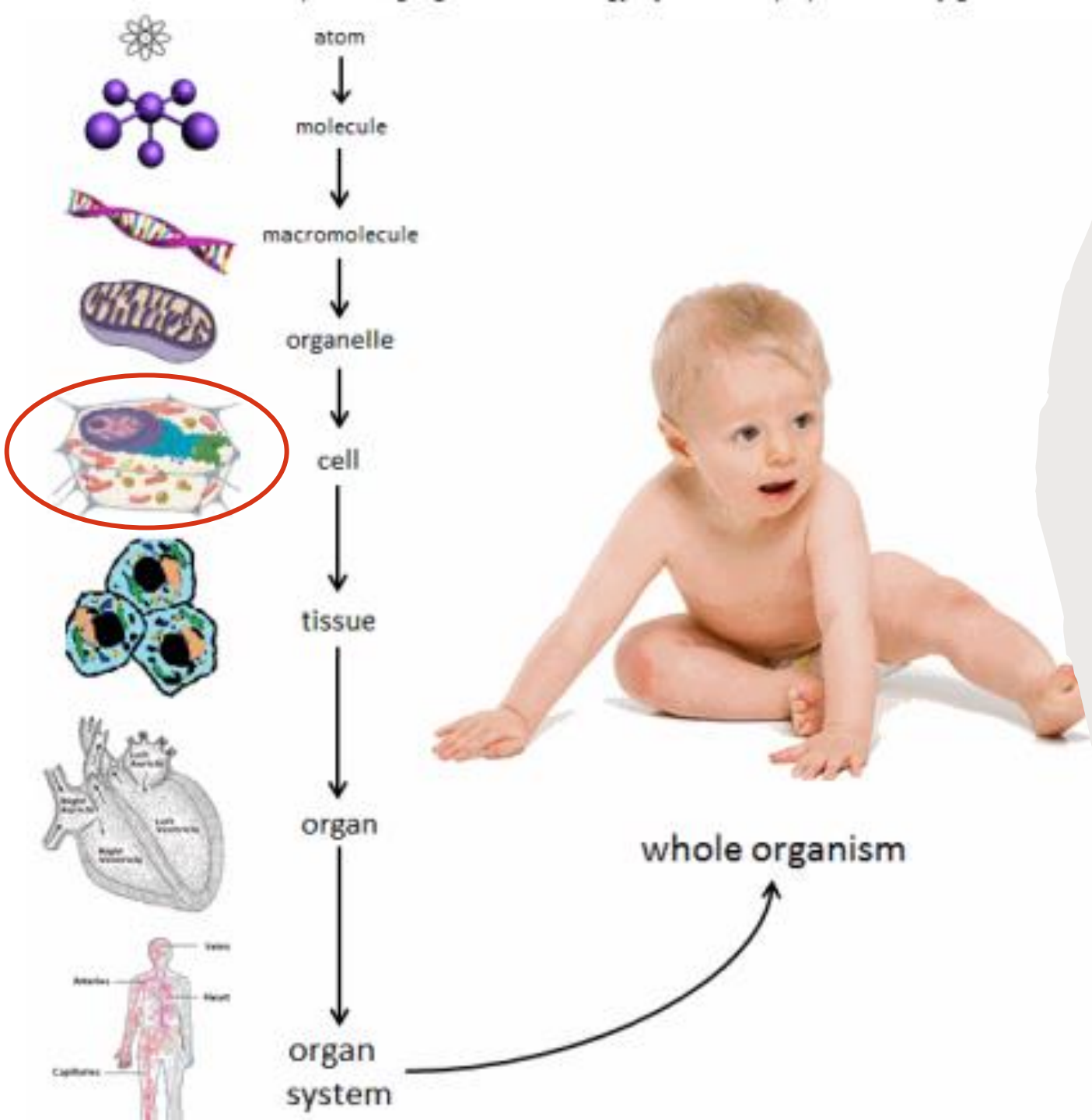


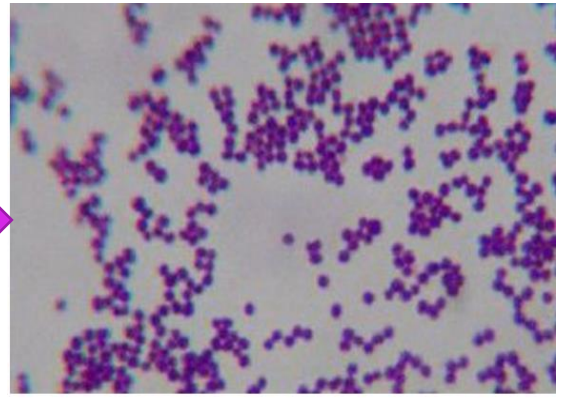
THE HIERARCHY OF LIFE



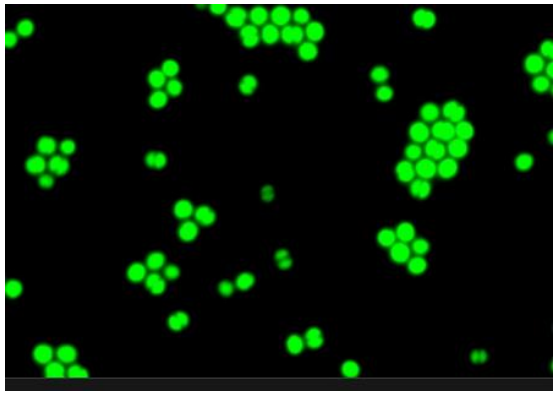
- A cell is the smallest functional unit that can perform all of life's tasks.
- A living organism may consist of a single cell or a huge number of cells.
- In multicellular organisms, cells are specialized and depend on other cells to maintain life.
- The specialization and interdependence of cells contribute to a characteristic hierarchy of life, with each level defined by its structures and function.

INTRODUCTION

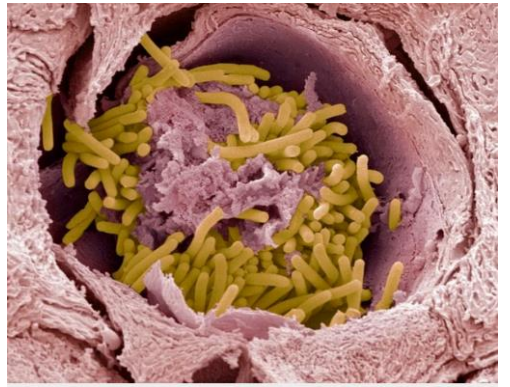
- Microorganisms – several classes of living beings.
- Based on the organization of their cellular structures, all living cells can be divided into two groups: eukaryotic and prokaryotic.
- Eukaryotic cell types – Animals, plants, fungi, protozoans, and algae.
- Prokaryotic cell types – bacteria & blue green algae.
- Since microscopy was invented, the development of microorganism research has also been increasingly advance.

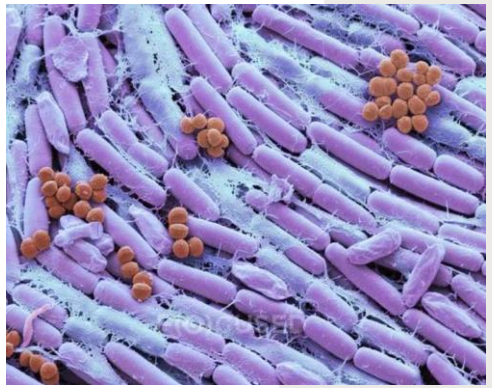


Light microscope.



Fluorescence microscope.

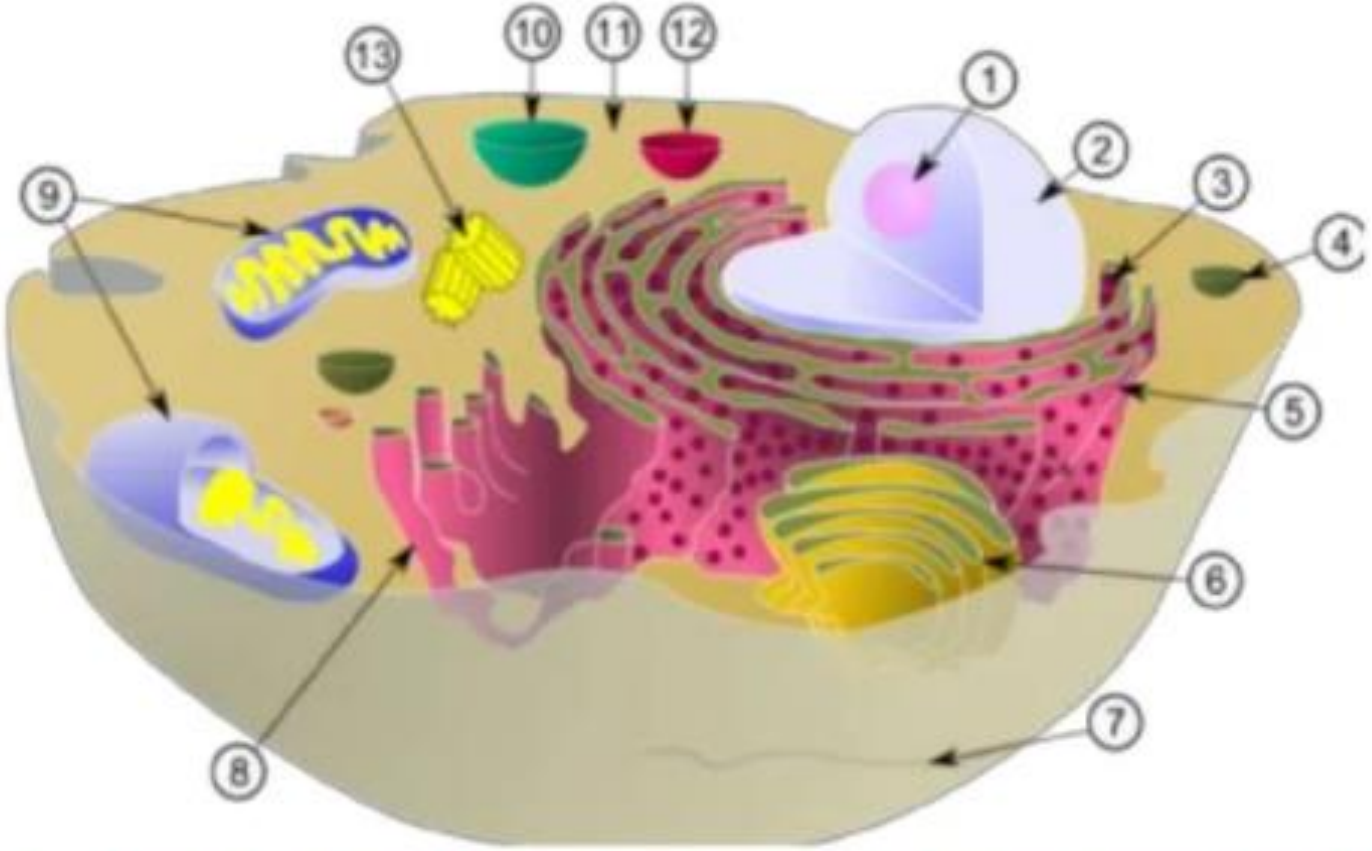




Scanning Eelectrone microscope (SEM).

EUKARYOTES CELLS

- Eukaryotes cells have organelles
- Much larger; more complex than prokaryotes
- Processes compartementalized into organelles
  - Nucleus
  - Protein synthesis (ribosomes, RE, Golgi)
  - Mitochondria; chloroplasts
  - Lysosomes
  - Plasma membranes have different modification
  - Cytoskeleton



Schematic of typical animal (eukaryotic) cell, showing subcellular components.

Organelles: (1) nucleolus (2) nucleus (3) ribosome (4) vesicle
(5) rough endoplasmic reticulum (ER) (6) Golgi apparatus (7) Cytoskeleton
(8) smooth ER (9) mitochondria (10) vacuole
(11) cytoplasm (12) lysosome (13) centrioles

PROKARYOTIC CELLS

- Prokaryotic cells didn't have organelles.
- Much smalled (microns) and more simple than eukrayotes.
- Prokaryotes are molecules surrounded by a membrane and cell wall.
- They lack a true nucleus and don't have membrane bound organelles like mitochondria, etc.
- Large surface-to-volume ratio: nutrients can easily and rapidly reach any part of cells interior.

BACTERIAL STRUCTURE

- All cells have 3 main components:
  - DNA ('nucleoid")
    - genetic instructions
  - surrounding membrane ("cytoplasmic membrane")
    - limits access to the cell's interior
  - cytoplasm, between the DNA and the membrane
    - where all metabolic reactions occur
    - especially protein synthesis, which occurs on the ribosomes
- Bacteria also often have these features:
  - cell wall
    - resists osmotic pressure
  - flagella
    - movement
  - pili
    - attachment
  - capsule
    - protection and biofilms

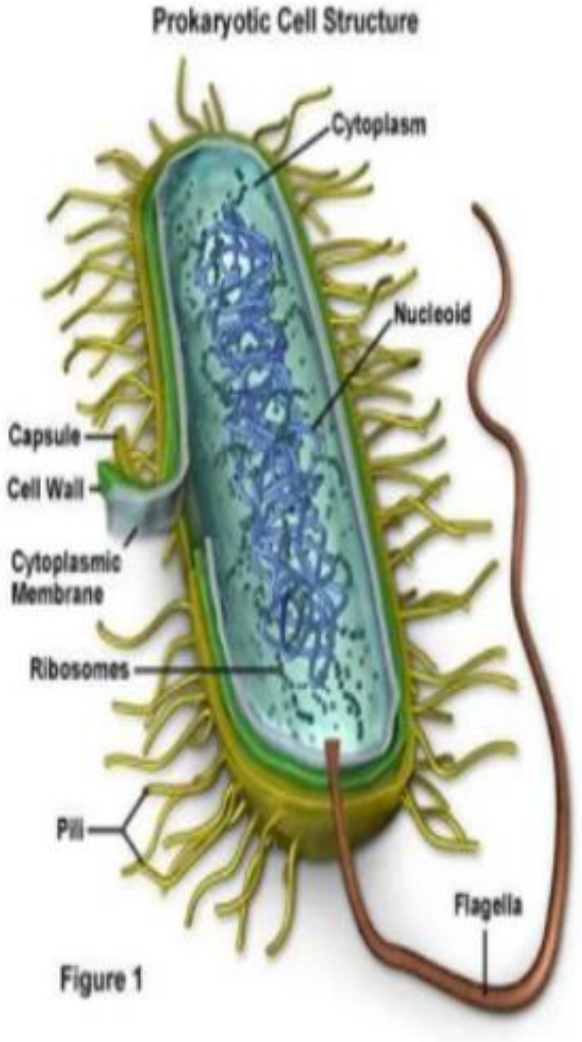
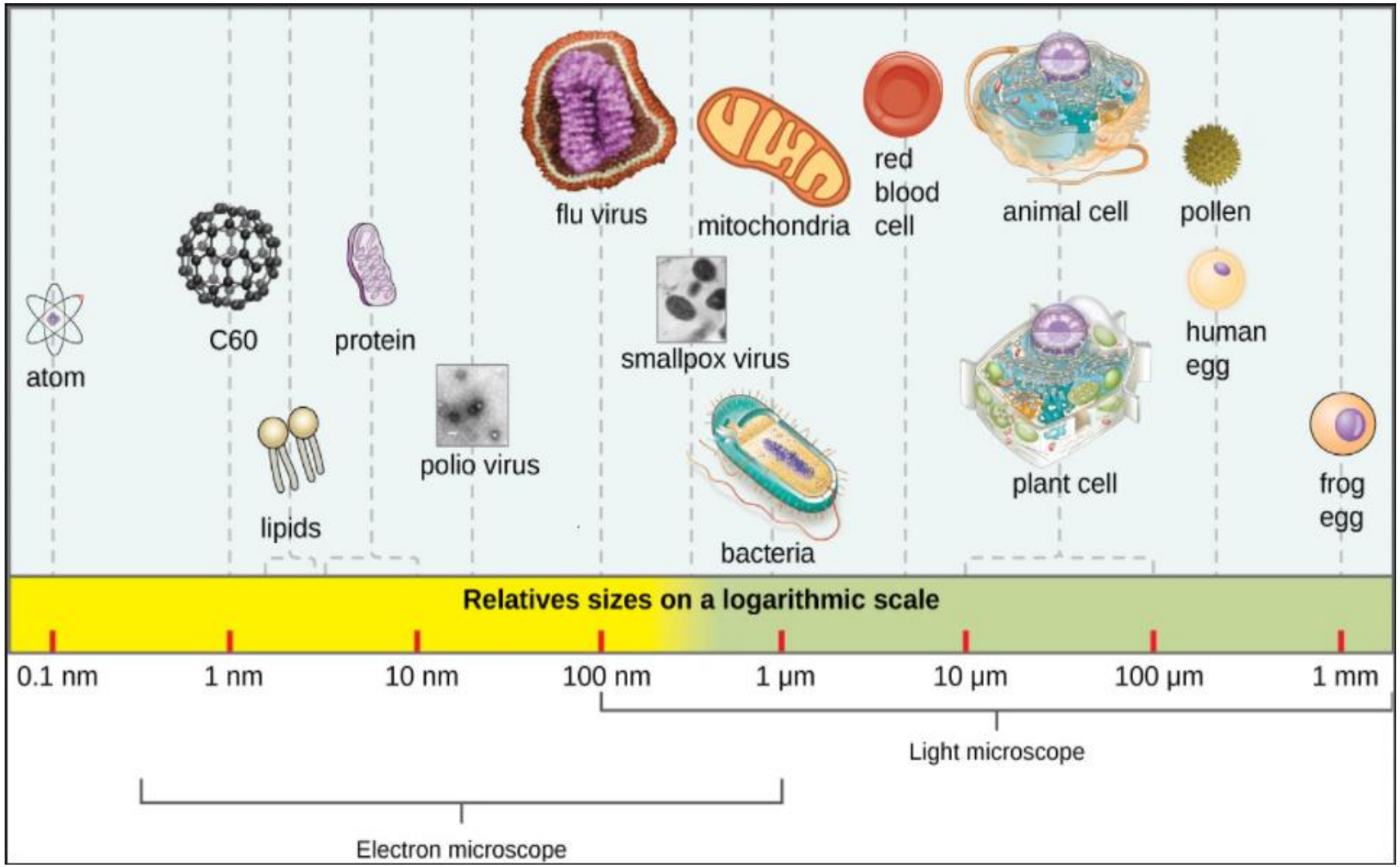
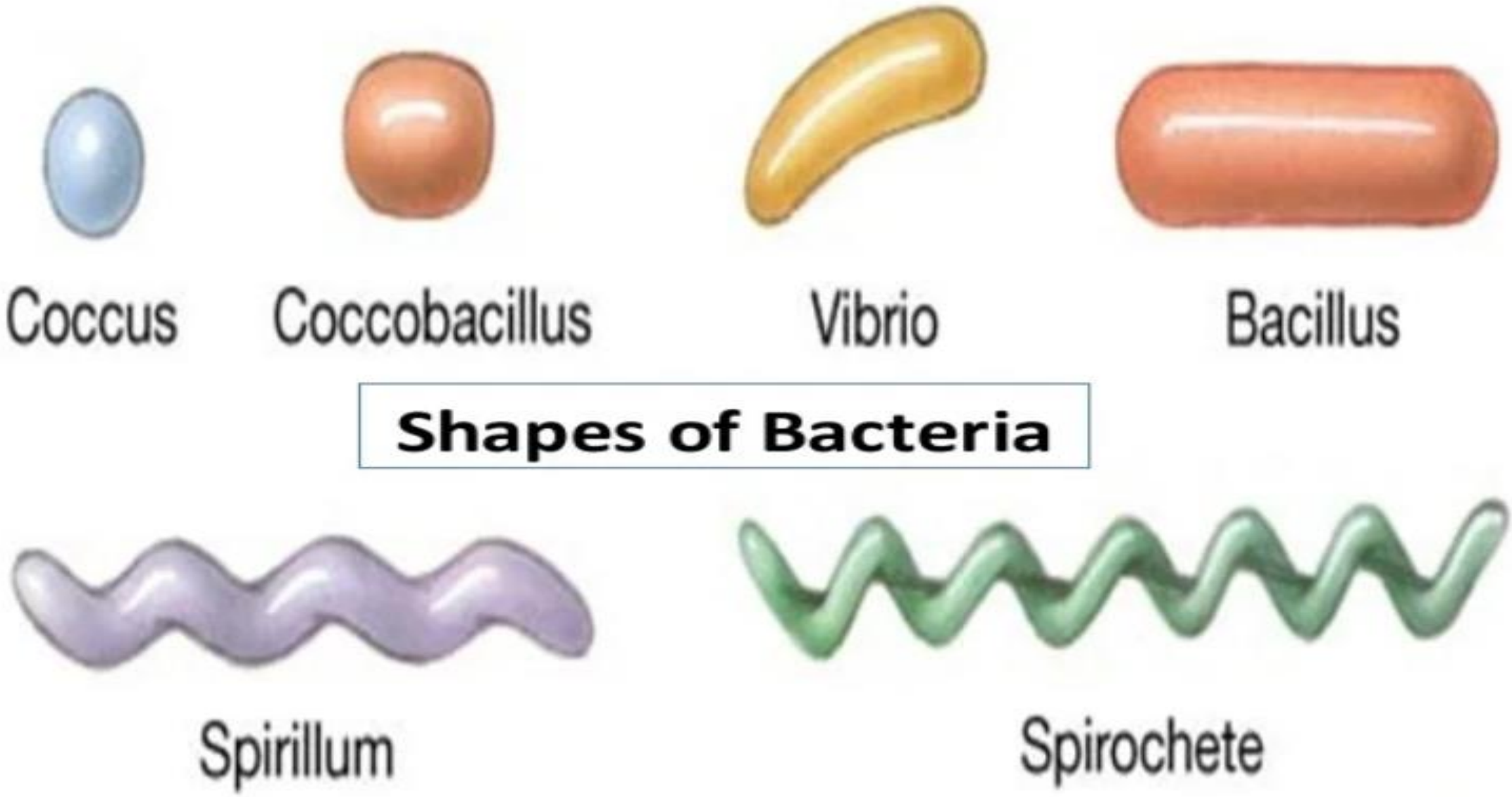


Figure 1

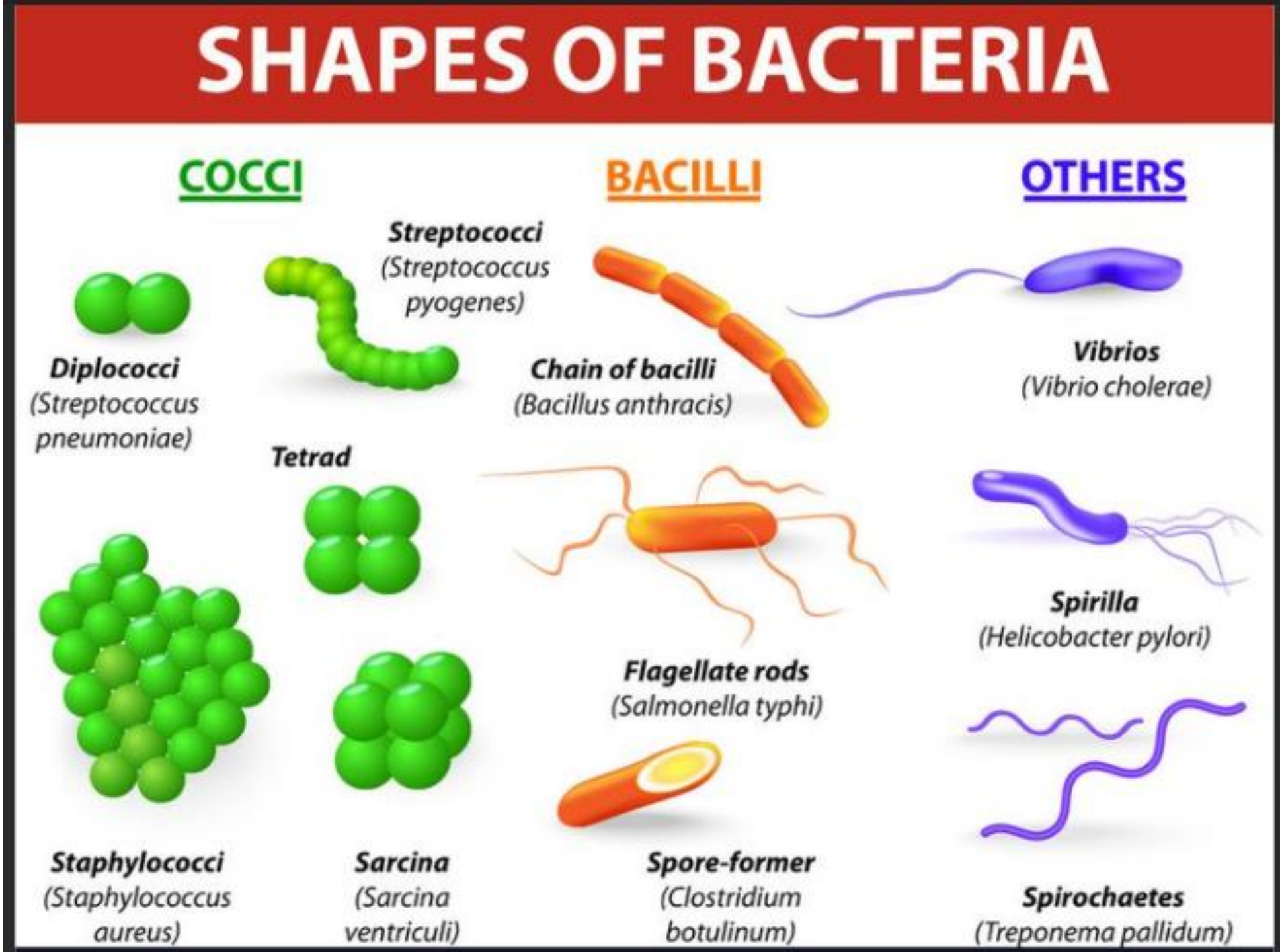
SIZE OF BACTERIA



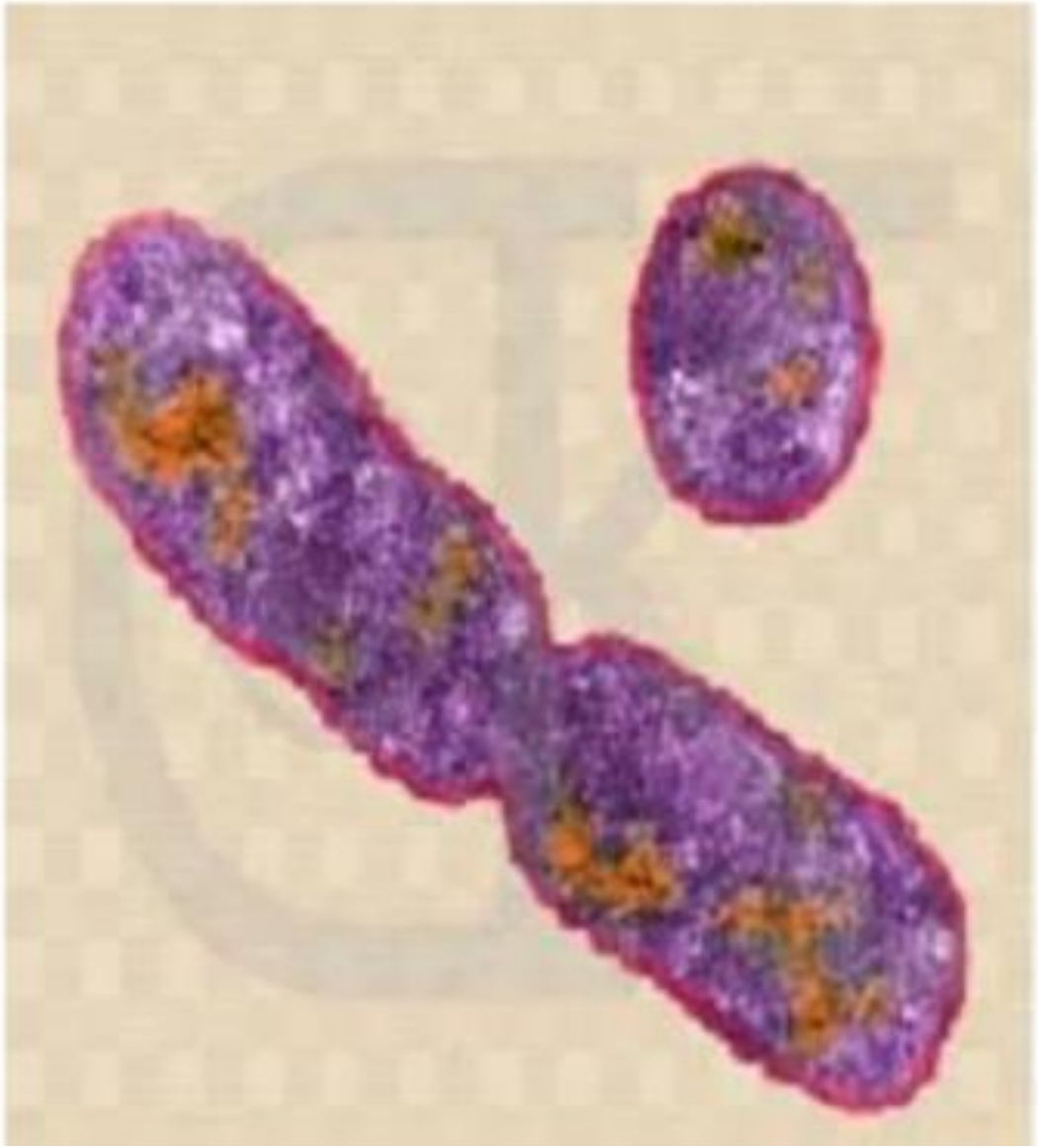
- Unit of measurement in bacteriology is the micron (micrometre, µm)
- Bacteria of medical importance
- 0.2 – 1.5 µm in diameter
- 3 – 5 µm in length


Coccus
Coccobacillus
Vibrio
Bacillus
Shapes of Bacteria
Spirillum
Spirochete

SHAPES OF BACTERIA

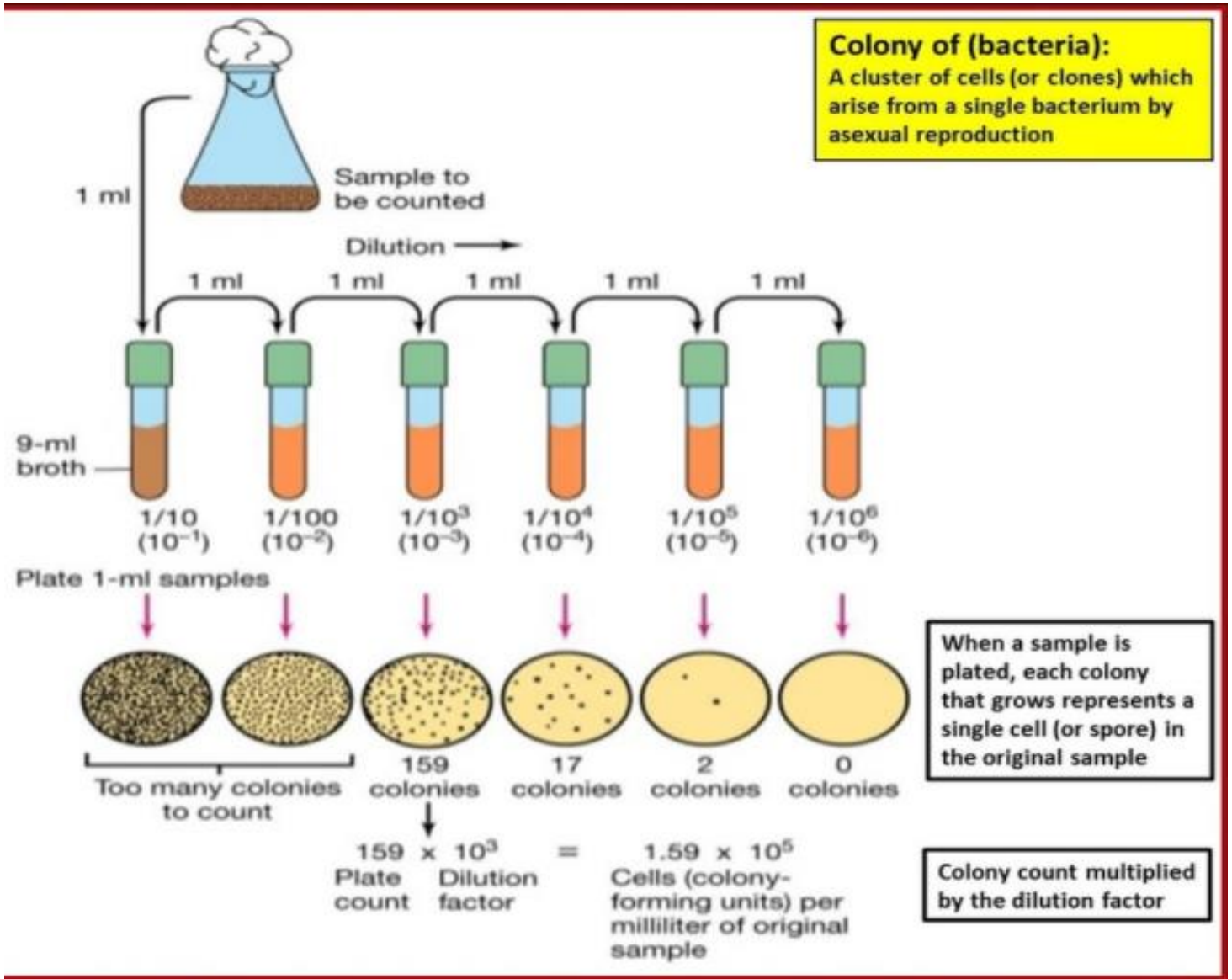


REPRODUCTION



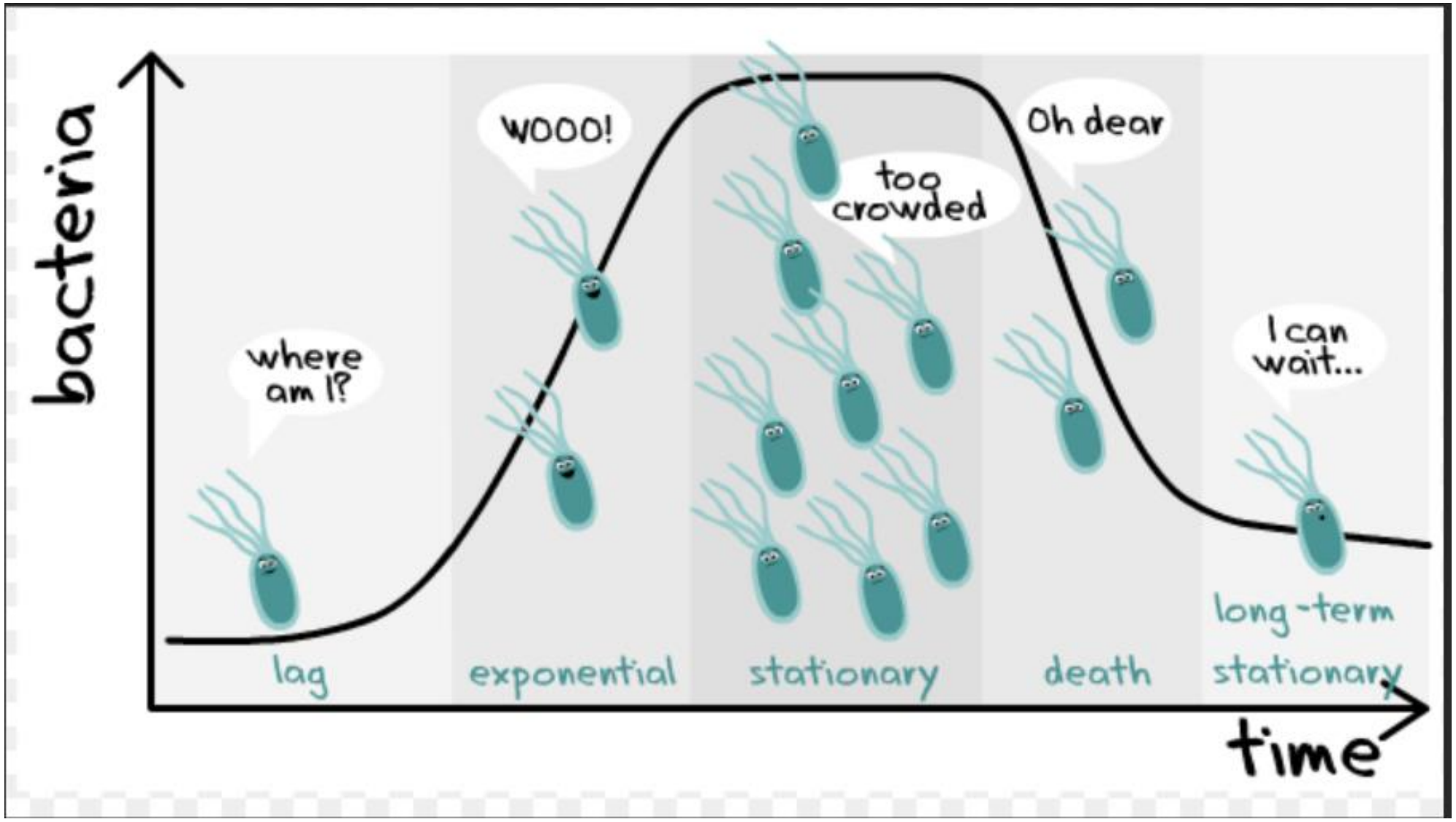
- Prokaryotic cell division is binary fission.
  - Single DNA molecule that first replicates.
  - Attaches each copy to a different part of the cell membrane.
  - Cell begins to pull apart.
  - Following cytokinesis, there are then two cells of identical genetic composition.

GROWTH & METABOLISM OF BACTERIA



Bacteria in growth media.

GROWTH PHASE OF BACTERIA



Factors Influencing Microbial Growth

Temperature

Atmosphere – O_2 & CO_2

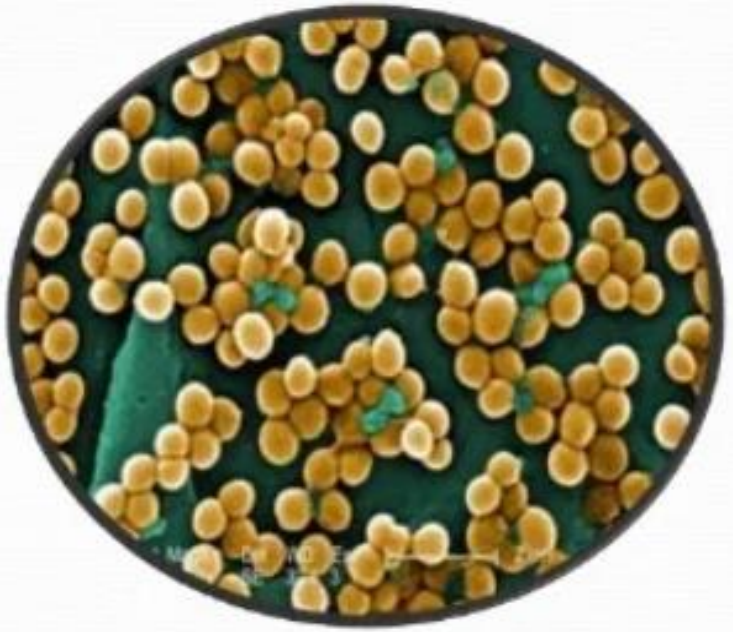
H-ion concentration (pH)

Moisture & drying

Osmotic effects

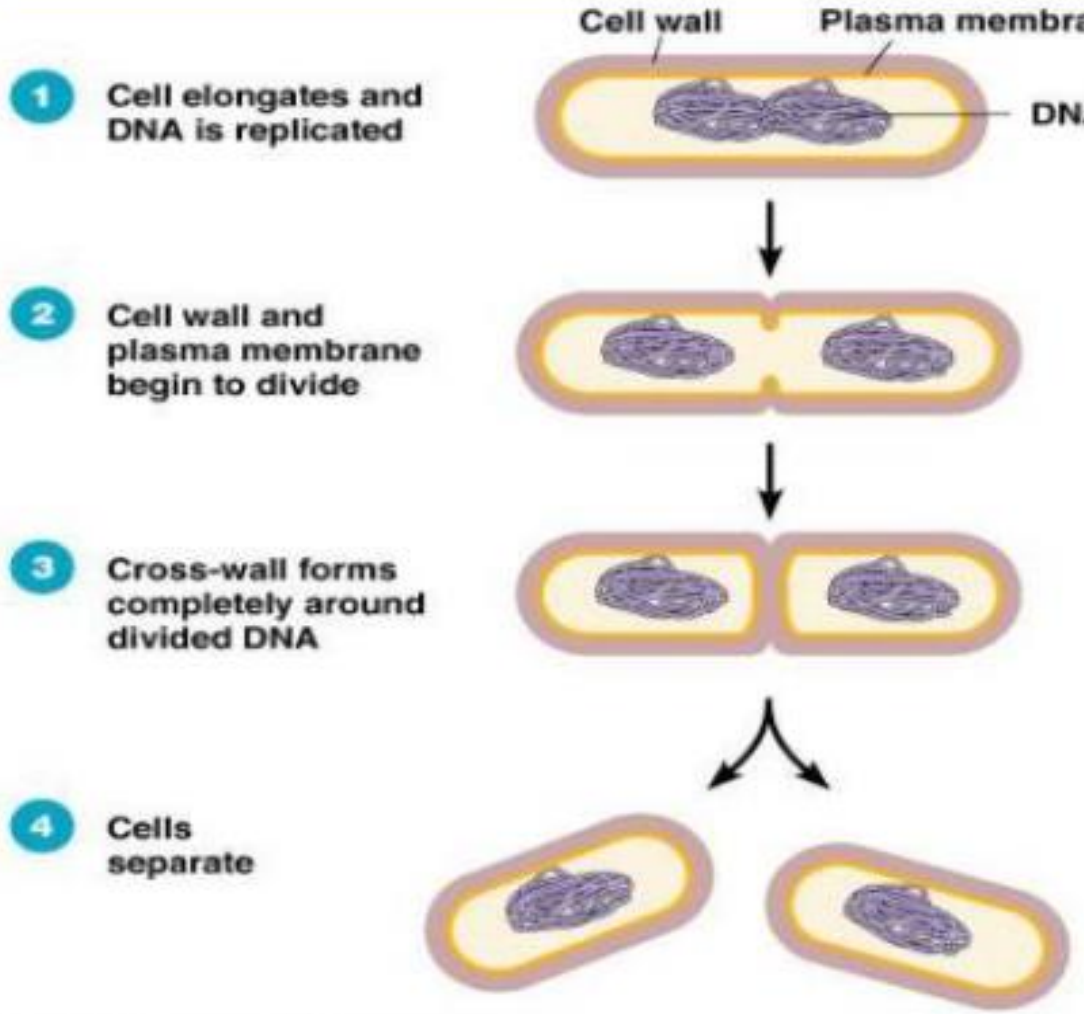
Radiation

Mechanical & sonic stress.

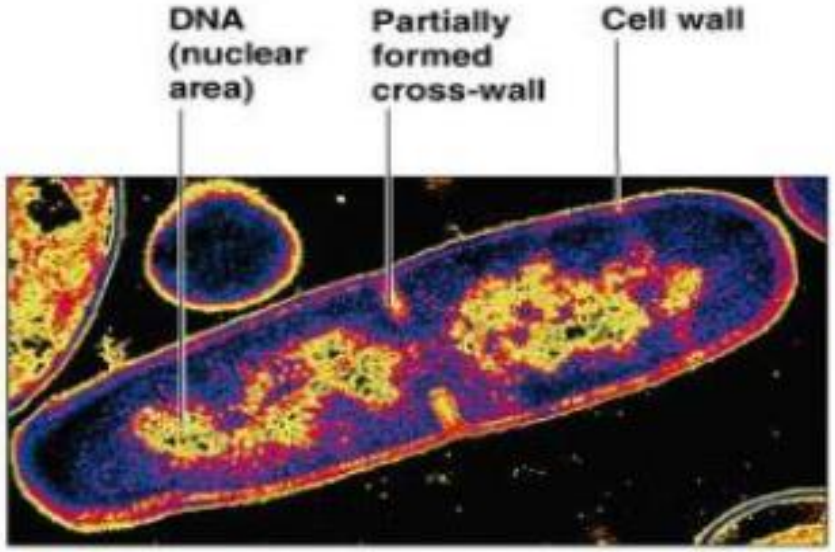


This scanning electron micrograph (SEM) depicts numerous clumps of methicillin-resistant ***Staphylococcus aureus*** bacteria, commonly referred to by the acronym, MRSA, by Janice Haney Carr, PHIL #10046

BACTERIAL GENETICS



(a) A diagram of the sequence of cell division.

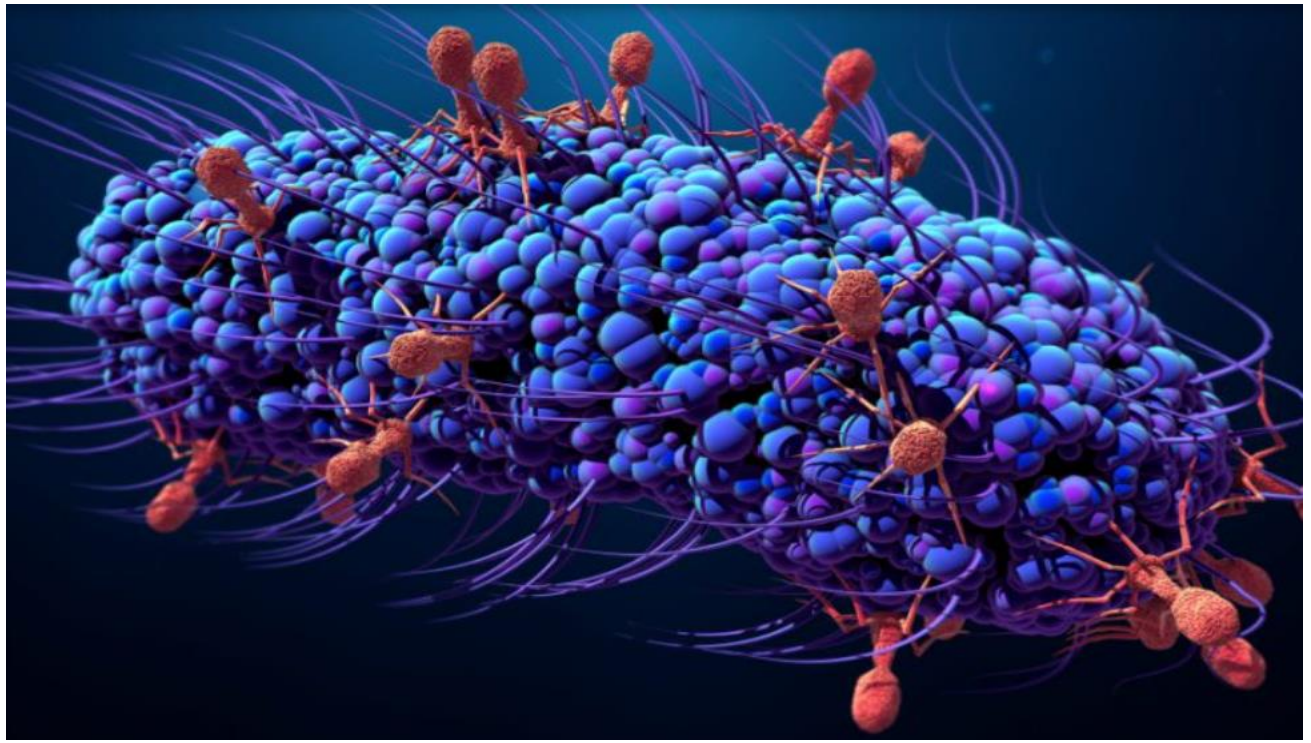


(b) A thin section of a cell of *Bacillus licheniformis* starting to divide.

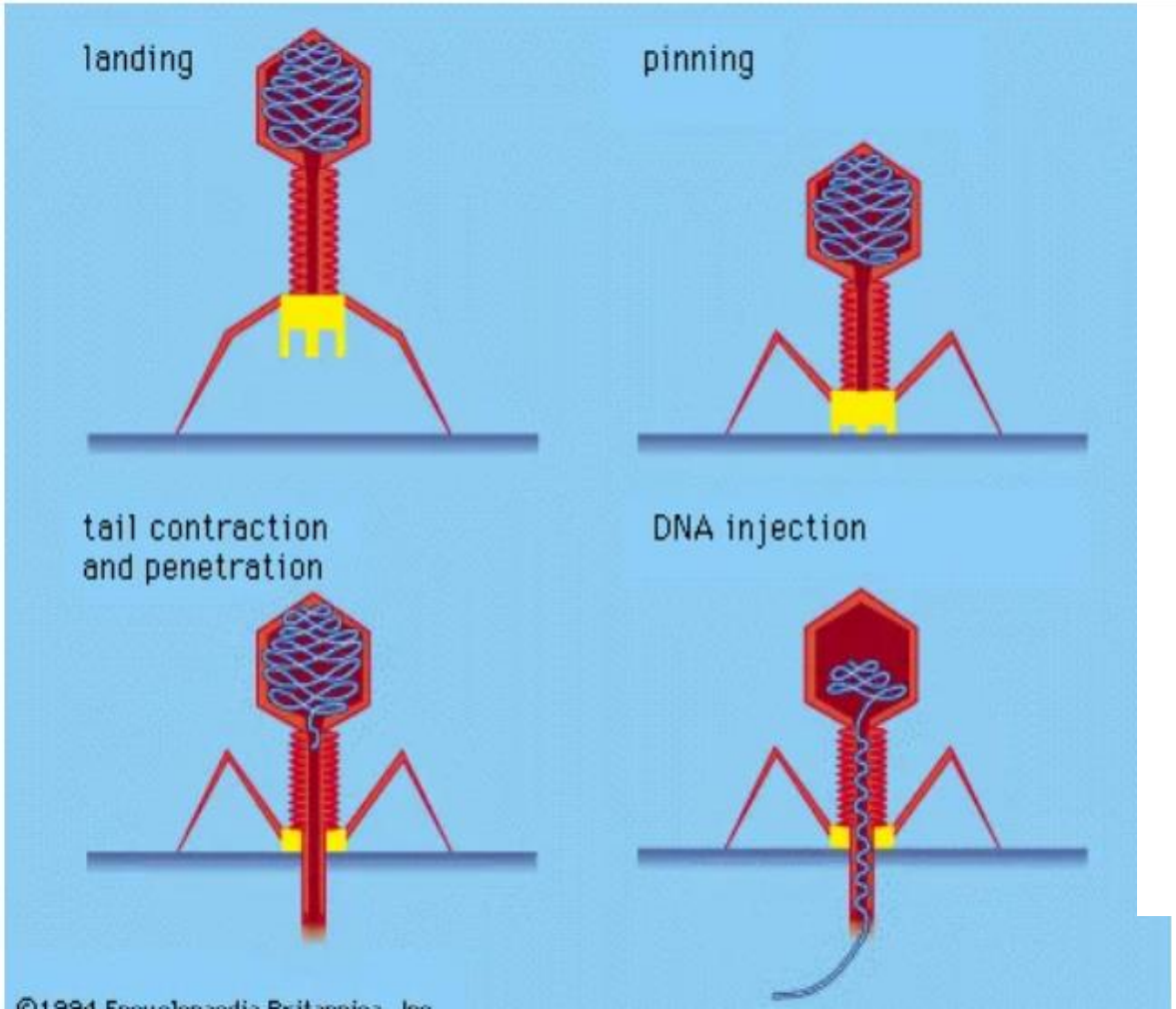
BACTERIOPHAGE

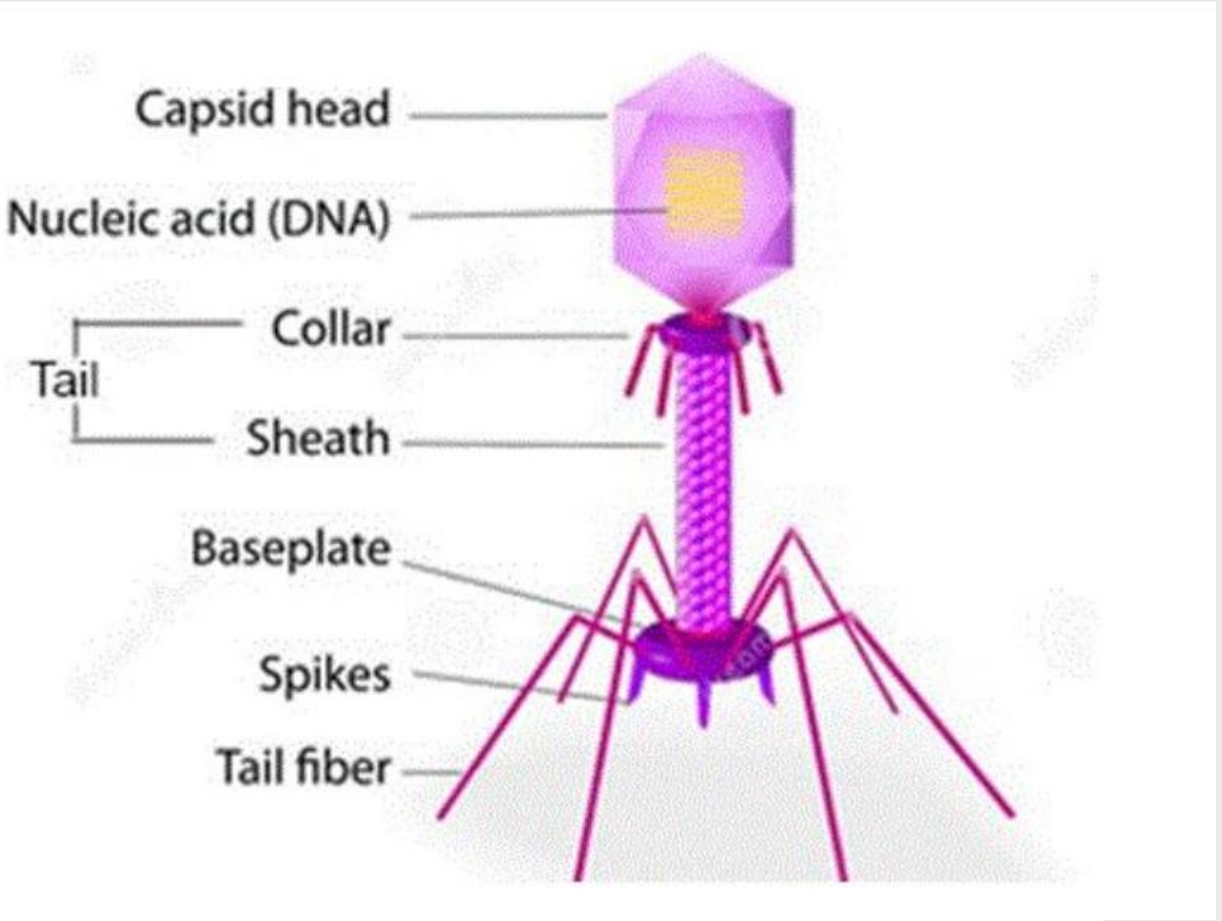
A bacteriophage is a type of virus that's infects bacteria. In fact, the word "bacteriophage" literally means "bacteria eater", because bacteriophages destroy their host cells.

All bacteriophaged are composed of a nucleic acid molecule that is surrounded by a protein structure.

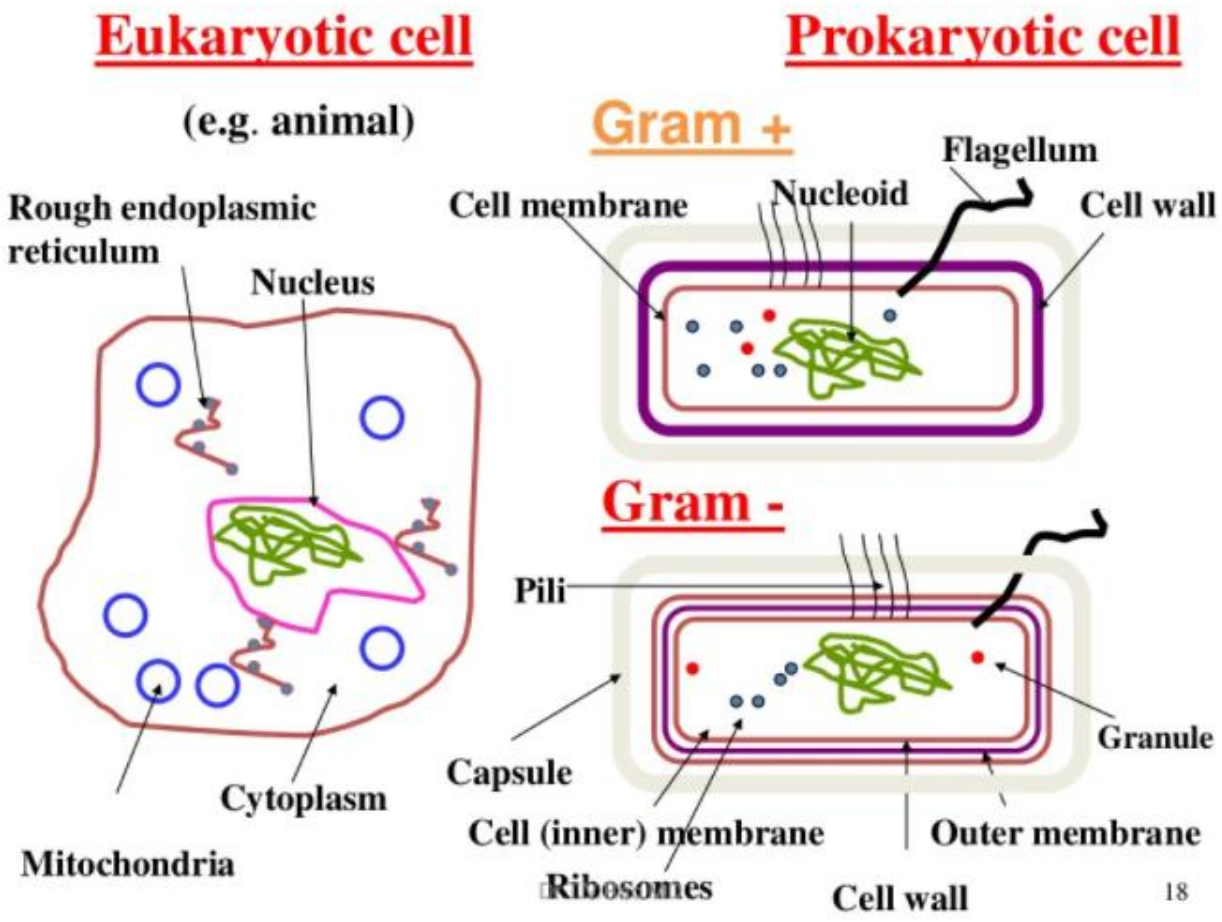


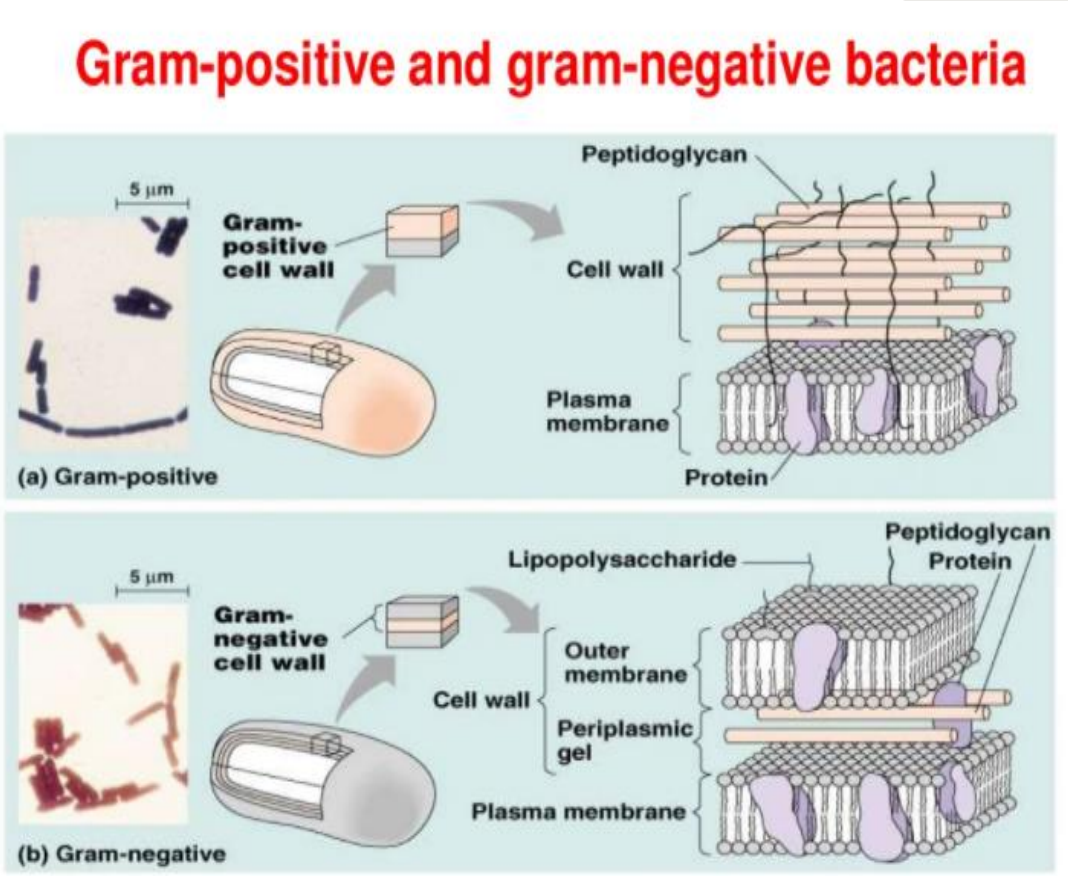
HOW VIRUS INFECT BACTERIA?





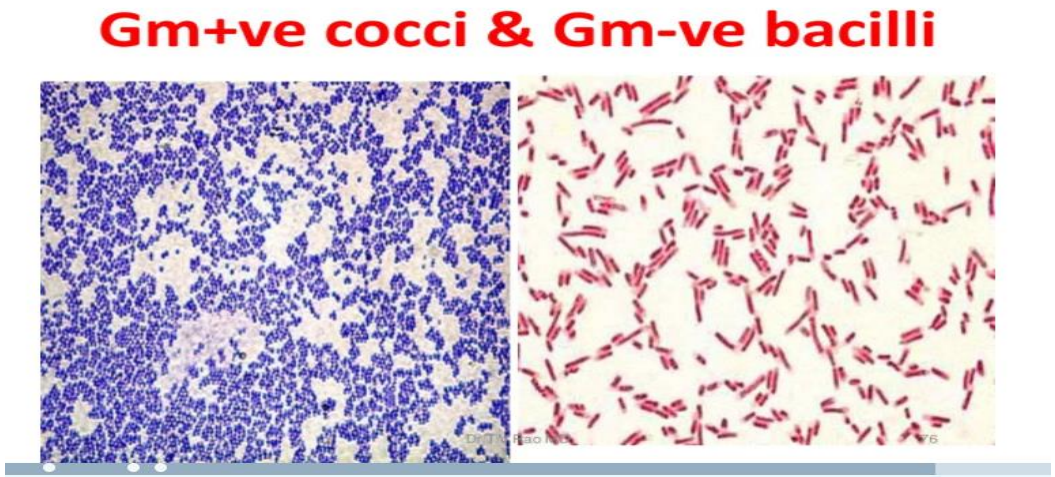
GRAM POSITIVE & NEGATIVE BACTERIAE





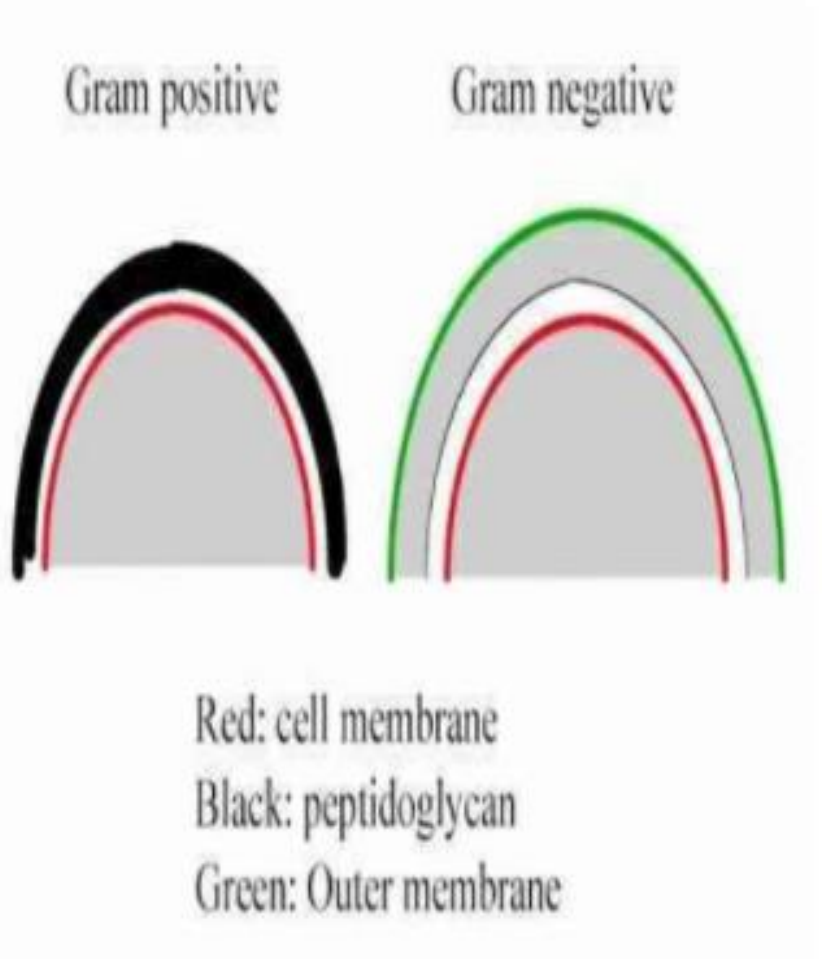
THE DIFFERENCES BETWEEN GRAM POSITIVE & GRAMNEGATIVE BACTERIA

Gram Positive Bacteria	Gram Negative Bacteria
Simple cell wall.	More complex cell wall.
Thick peptidoglycan cell wall layer	Thin peptidoglycan cell wall layer
No outer lipopolysaccharide wall layer	Outer lipopolysaccharide wall layer
Retain crystal violet/iodine	Retain safranin
Appear blue/purple	Appear pink/red



Cell Envelope

- The cell envelope is all the layers from the cell membrane outward, including the cell wall, the periplasmic space, the outer membrane, and the capsule.
  - All free-living bacteria have a cell wall
  - periplasmic space and outer membrane are found in Gram-negatives
  - the capsule is only found in some strains



AEROBIC & ANAEROBIC BACTERIA

Bacteria are unicellular, prokaryotic organisms that help in decomposing organic materials and fix atmospheric nitrogen. Bacteria are classified as aerobic and anaerobic based on the type of respiration.

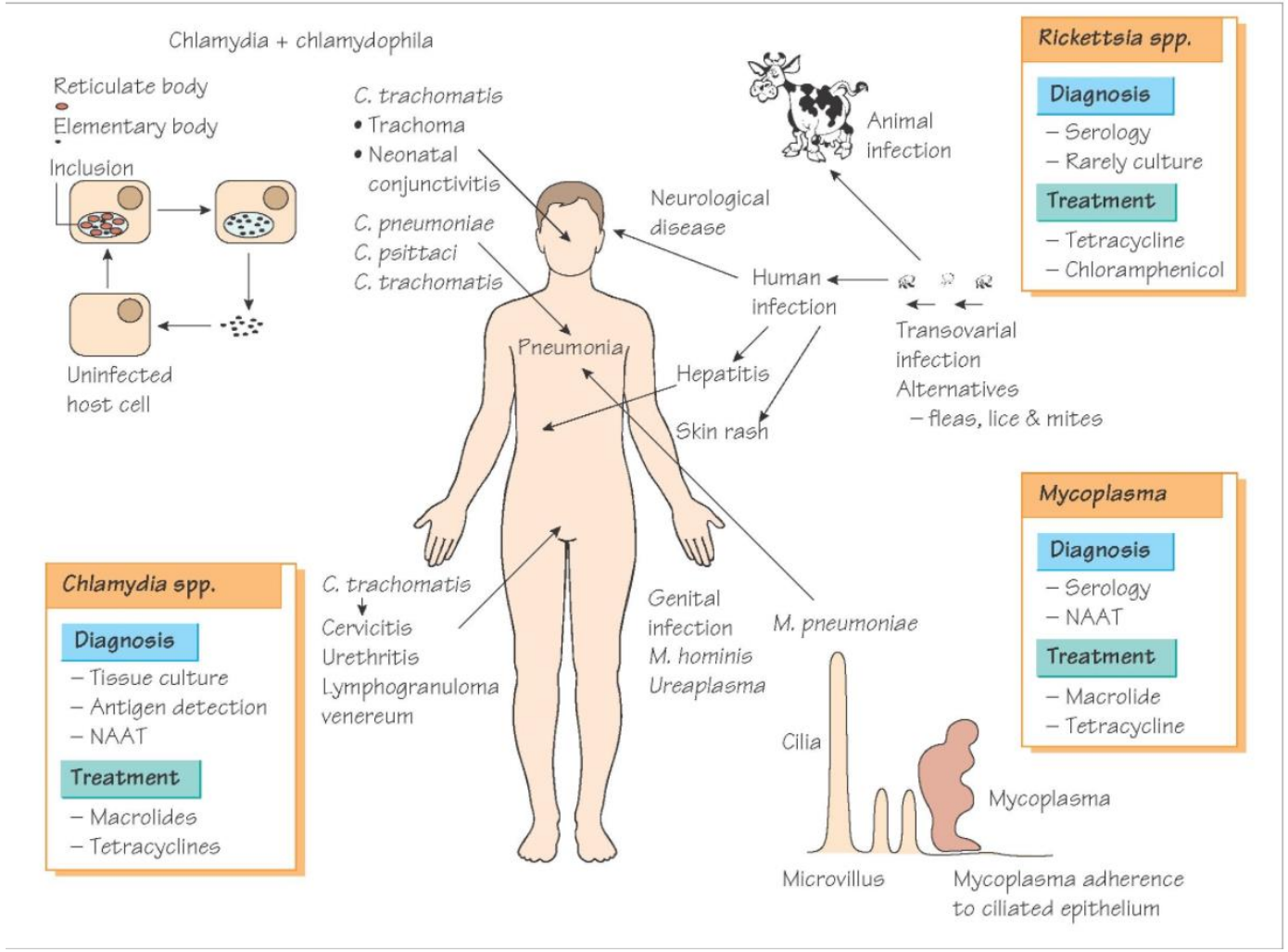
Difference between Aerobic and Anaerobic	
AEROBIC	**ANAEROBIC**
Need oxygen to survive	Do not require oxygen to survive
Produce more energy	Produce less energy
Molecular oxygen is the final electron acceptor	Carbon dioxide, sulfur, fumarate or ferric is the final electron acceptor
Bacteria are seen on the surface of liquid	Bacteria are settled at the bottom of the liquid
Example: Mycobacterium tuberculosis	Example: Clostridium

CHLAMYDIA & RICKETTSIA

Two key differences.

CHLAMYDIA	RICKETTSIA
Chlamydia is a group of gram-negative bacteria and obligate intracellular parasite that transmits from person to person	Rickettsia is a group of gram-negative bacteria and obligate intracellular parasites that transmit by arthropod vectors
Cannot produce ATP	Can produce some ATP

CHLAMYDIA & RICKETTSIA



WANTED : GOOD BACTERIA

Want to look and feel your very best? Start enjoying more foods naturally high in probiotics — and in the fiber-rich prebiotics that help those good bugs thrive.

PROBIOTIC-RICH FOODS

DAIRY SOURCES

- Yogurt
- Kefir
- Buttermilk
- Crème fraîche
- Lassi, a drink made from yogurt and water
- Aged cheeses, such as bleu, Gouda and cheddar

FRUIT AND VEGETABLE SOURCES

- Brined pickles
- Tangy chutneys
- Brined olives
- Sauerkraut and its ethnic variations — kimchi (Korean), tsukemono (Japanese), choucroute (French)
- Sauerruben (fermented sour turnips)
- Pickled beets

SOYBEAN SOURCES

- Miso
- Tempeh
- Natto
- Soy sauce
- Tamari

GRAIN SOURCES

- Traditional sourdough breads

NONDAIRY BEVERAGES

- Kombucha

PREBIOTIC-RICH FOODS

VEGGIES

- Tomatoes
- Artichokes
- Onions
- Chicory
- Greens (especially dandelion greens)
- Asparagus
- Garlic
- Leeks

FRUIT

- Berries
- Bananas

WHOLE GRAINS

- Oatmeal
- Barley
- Flaxseeds
- Wheat

LEGUMES

- Lentils
- Kidney beans
- Chickpeas
- Navy beans
- White beans
- Black beans

QUIZ

1. Please mention the names of human disease caused by bacteria?! (minimum 5)

 - Specific name of the bacteria and name of the disease caused.

For example: diarrhea caused by bacteria Campylobacter, Salmonella, Shigella, and E. Coli.

2. What do you know about antibiotic? Explain.

Send to my email: wi2t_probo@yahoo.com
The deadline: 22 March 2022 at 9.00.

DISCUSSION?