

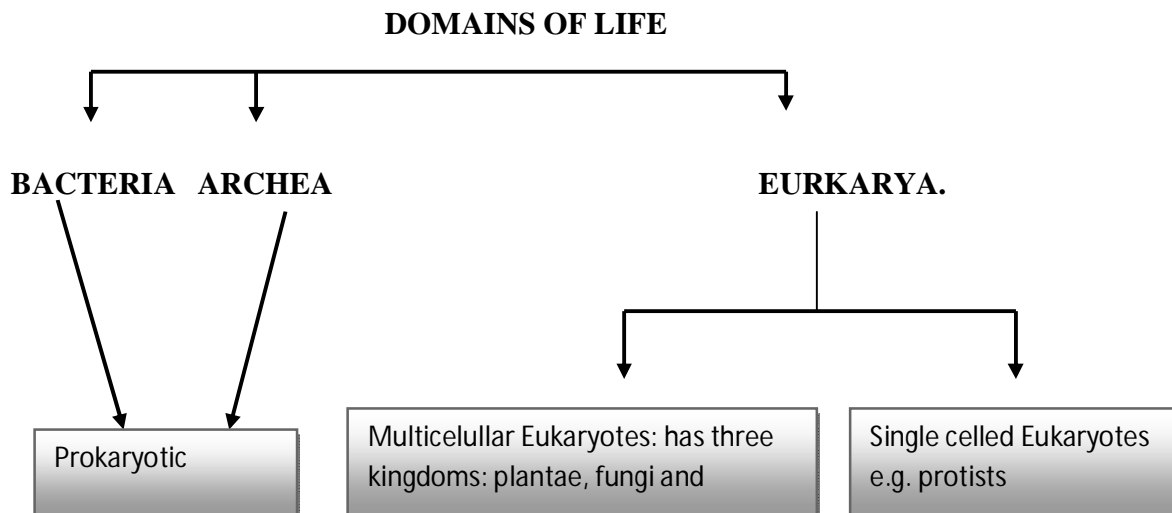
Tutorial 01d

Study Unit 2

Thanks for your involvement in making this group an interactive one. If you are yet to participate, Please do.

As it has been mentioned in my welcome address that all the tutorials will be based on what the Lecturer has designed. Even though, I tried (and will try in subsequent ones) to simplify the module for the purpose of your understanding, I would like to say that **IT IS NOT EXHAUSTIVE IN ITSELF**. Hence, onus lies on you to study and study to ensure maximum achievement. To this effect, only highlight excerpt are presented here. This also will cut across all tutorials that I would be pasting on myunisa.

The three domains of life are a higher level than the kingdom level. These are bacteria, archea and Eukarya.



Eukarya are distinguished by their mode of nutrition

- **Plantae**- terrestrial multicellular Eukaryotes (land plants)*manufacture their food through the process of photosynthesis*
- **Fungi**- absorbs dissolved nutrient from their surrounding, the organic waste and decomposing dead organism
- **Animalia** feeds by ingestion that is eating and digesting other organism

Domain Bacteria (Prokaryotes) is most diverse and widespread and are classified into multiple kingdoms

Domain ARCHEA (prokaryotes) live in extreme environment salty lakes, hot water spring

Cell size

Prokaryotes are 0.5-5 μ m in diameter (smaller)

Eukaryotes are 10-100 μ m diameter (bigger)

Cell structure

Prokaryotes has a cell wall

Functions of cell wall

- Maintain shape
- Protect cell
- Prevents bursting in hypotonic environment

In hypertonic environment they shrink. This called plasmolysis.

Bacteria		
Shape	Name	
Spherical	Cocci	(singular: coccus) Pairs: diplococci Chain: streptococci Bunch or cluster: staphylococci
Rod shaped	Bacilli	Single: bacillus Chain: streptobacilli
Helical	Spirilla	

Hypotonic environment the concentration of the environment is lower than the concentration of the cell

Hypertonic environment the concentration of the cell is lower than the concentration of the environment.

Cell wall	
Prokaryotes	Eukaryotes
Peptidoglycan- a polymer composed of modified sugar cross linked by short polypeptides	cellulose
Some has polysaccharide called capsule	Chitin

Gram stain classify bacteria into two groups depending on their cell wall composition

Gram positive	Gram negative
Simple cell wall	Complex cell wall
Large peptidoglycan	Smaller peptidoglycan
Does not contain lipopolysaccharides	Contains lipopolysaccharides (carbohydrates bonded to lipids)

Significance of Gram stain to medicine

- It helps in identification of the type of bacteria that infects such a person
- It informs the type of treatment to be administered to the patient
- It also informs if it is gram negative that possibility of release of toxic from the lipopolysaccharides of the gram negative bacteria which may lead to fever and shock
- Gram negative have greater resistance to antibiotic because of the outer membrane disallow the penetration of the medicines
- Medicines like penicillin which destroys peptidoglycan kills bacteria without destroying human cells which does not contain peptidoglycan

Taxis is the movement of bacteria towards or away from stimulus.

Chemotaxis- movement due to change in chemical in the environment either towards food or oxygen (positive chemotaxis) or away from toxic chemical (negative chemotaxis).

Movement is by flagella which is different in composition to that of Eukaryotes in composition and mechanism of propulsion

Prokaryotic cell are **not** internally compartmentalized but have several membrane performing metabolic functions they are the **in-foldings** of the plasma membrane

Genome is the genetic material of an organism. It is the complete complement of an organism's genes along with its noncoding nucleic acid sequences

Prokaryotes	Eukaryotes
Circular chromosomes	Linear chromosomes
Less DNA	Relatively more DNA
Lack membrane bounded nucleus	nucleus bounded by membrane
Chromosomes in nucleoid- region of cytoplasm that is lighter	Chromosomes in nucleus
Contains plasmids	

Reproduction

prokaryotes reproduces through the process called binary fission

Endospore is highly resistant cell produced by some prokaryotes when there is lack of nutrient or harsh conditions. It lacks water and every metabolism stops but when in a favorable condition it rehydrates and resumes metabolism.

Features of prokaryotes

- Small
- Reproduces by binary fission
- Have short generational times

- some withstand harsh conditions

Conjugation is the process in which DNA is transferred between two prokaryotic cells (Usually of the same species) that are temporary joined together.

In bacteria the DNA is donated by one cell i.e. the cell carrying the F factor in form of plasmid or in the F factor may be combined with the chromosome.

The cell with F plasmid is F⁺ and the recipient is F⁻

The chromosome with the F factor is Hfr⁺ and recipient is F⁻

Nutrition

- Obligate aerobes uses oxygen for cellular respiration and cannot grow without oxygen
- Obligate anaerobes live by fermentation. They do not use oxygen at all
- Facultative anaerobe uses oxygen however they can also live by fermentation

Prokaryote metabolizes nitrogen in a wide variety. Cyanobacteria through the process called nitrogen fixation convert atmospheric Nitrogen to ammonia. These bacteria only need light water and carbon dioxide (CO₂) and nitrogen (N₂) to grow

Metabolism is the totality of an organism s chemical reactions consisting of catabolic and anabolic pathways, which manage the material and energy resources of the organism.

Major nutritional modes			
Modes	energy source	Carbon source	Types of organism
Autotroph			
Photoautotroph	Light	CO ₂ , HCO ₃ ⁻ , or related compounds	Photosynthetic prokaryotes e.g cyanobacteria, plants and some protest e.g Algae
Chemoautotroph	Inorganic chemicals such as H ₂ S, NH ₃ or Fe ²⁺	CO ₂ , HCO ₃ ⁻ , or related compounds	Unique to certain prokaryotes (e.g. suffolobus)

Heterotroph			
photoheterotroph	Light	Organic compound	
chemoheterotroph	Organic compounds	Organic compound	Many prokaryotes.g clostridium, protists, fungi, animal and some plants

The ecosystem depends on the recycling of chemicals for continuity of life. These chemicals are recycled between the living and the non-living things of the environment. Highlighted below are the processes of recycling of chemicals:

- **Chemoheterotroph** prokaryotes functions as a decomposer. They breakdown dead organic matters and releasing the nutrients such as carbon, nitrogen, and other elements back into the environment.
- Prokaryotes like the cyanobacteria and other autotrophs convert molecules such as carbondioxide to form sugars which are used in the food chain
- Some produces oxygen and some fix atmospheric Nitrogen into forms that other organisms can use for building protein and nucleic acids
- They can also increase the nutrient such as Nitrogen, phosphorus but can as well decrease the key plant nutrient when the prokaryotes use the nutrient to synthesize molecules that stays within them. This is immobilization of the nutrients

Prokaryotes relationship with other organisms

Symbiosis meaning living together is an ecological relationship in which two species live in close contact with each other. It forms this kind of relationship with larger organism. The larger organism is host while the smaller is symbiont

Mutualism: an ecological relationship in which both benefit e.g. headlight in flashlight fish. The fish gives the bacteria nutrient and the bacteria in turn produce illumination to attract prey and signal to potential mate.

Commensalism: ecological relationship in which one benefit while the other is not harmed or helped in any way e.g. bacterial living on the surface of human skin.

Parasitism: an ecological relationship in which a parasite eat the cell content, tissue or body fluid of its hosts. The parasites harm but usually do not kill their hosts.

Parasite that cause disease are called pathogens

Bacteria	Disease caused
<i>Mycobacterium tuberculosis</i>	Tuberculosis
<i>Vibro cholera</i>	cholera
<i>salmonella typhi</i>	Typhoid fever

Exotoxin are protein secreted by bacteria. Cholera is caused by exotoxin produced by *Vibrio cholera*. The exotoxin stimulates the intestinal cells to release chloride ions into the guts and water follows by the process of osmosis.

Endotoxin is lipopolysaccharides components of outer membrane of gram-negative bacteria. The toxin in the case of endotoxin are released contrary to exotoxin, only when the bacteria dies and the cell wall breaks *salmonella typhi* causing typhoid fever

Difference between exotoxin and endotoxin

Exotoxin are secretions by bacteria while endotoxin are lipopolysaccharides components of outer membrane of gram-negative bacteria and only released when the bacteria dies.

Use of bacteria

- Bacteria is used to convert milk to cheese and youghrt
- Use of *E.coli* in cloning
- *Agrobacterium tumefaciens* in producing transgenic plants such as Golden rice
- Bacteria can be used to make natural plastic
- Some bacteria synthesize polymers known as Polyhydroxyalkanoate (PHA) which is used to store chemical energy. These PHA can be used to manufacture biodegradable plastics
- They are useful for bioremediation- using organisms to remove pollutants from the soil, air or water