Lecture (1)

INTRODUCTION TO MEDICAL MICROBIOLOGY

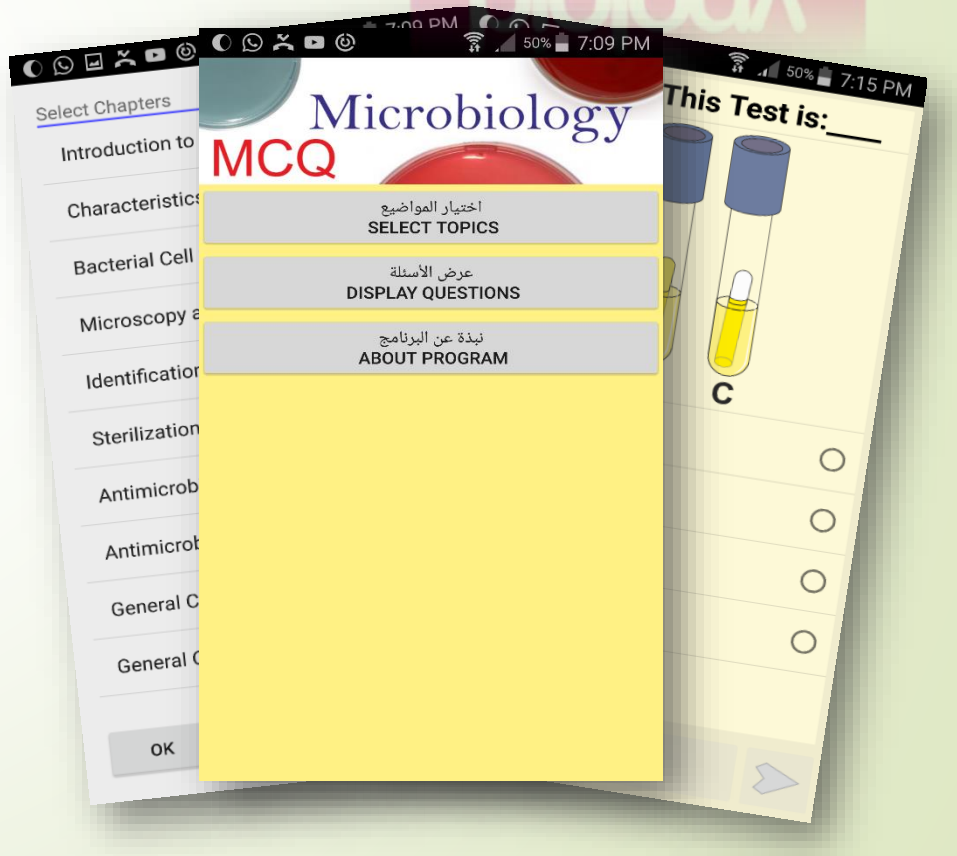
Study Sources

Teacher Web Site:

https://uqu.edu.sa/masaidahmed/microbiology

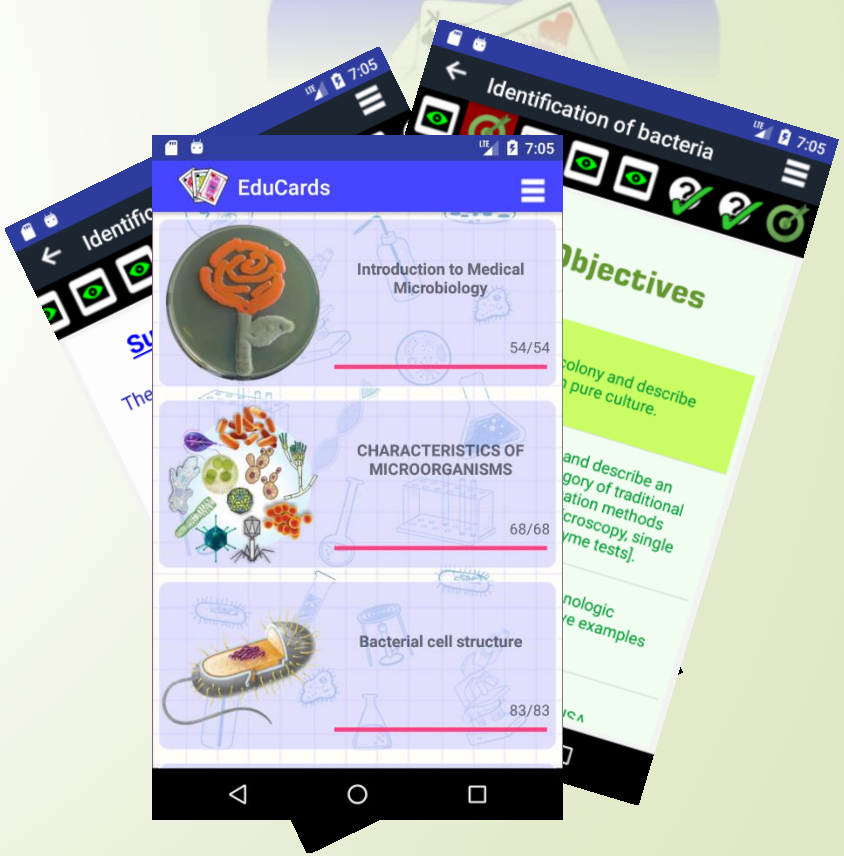
Android Program:
MCQ Basic Microbiology

https://play.google.com/store/apps/details?id=com.mohmicro.bm_mcqprogram



Android Program:
Microbiology EduCards

https://play.google.com/store/apps/details?id=com.mohmicro.educards



Objectives

1. Define **microorganisms** and the **science** of **microbiology**
2. Define taxonomy, nomenclature and binomial nomenclature.
3. Enumerate taxonomic ranks and the five kingdoms of life.
4. Compare and contrast **Eukaryotes** and **prokaryotes**.
5. List Major **groups** of **human pathogens**

Microbiology:

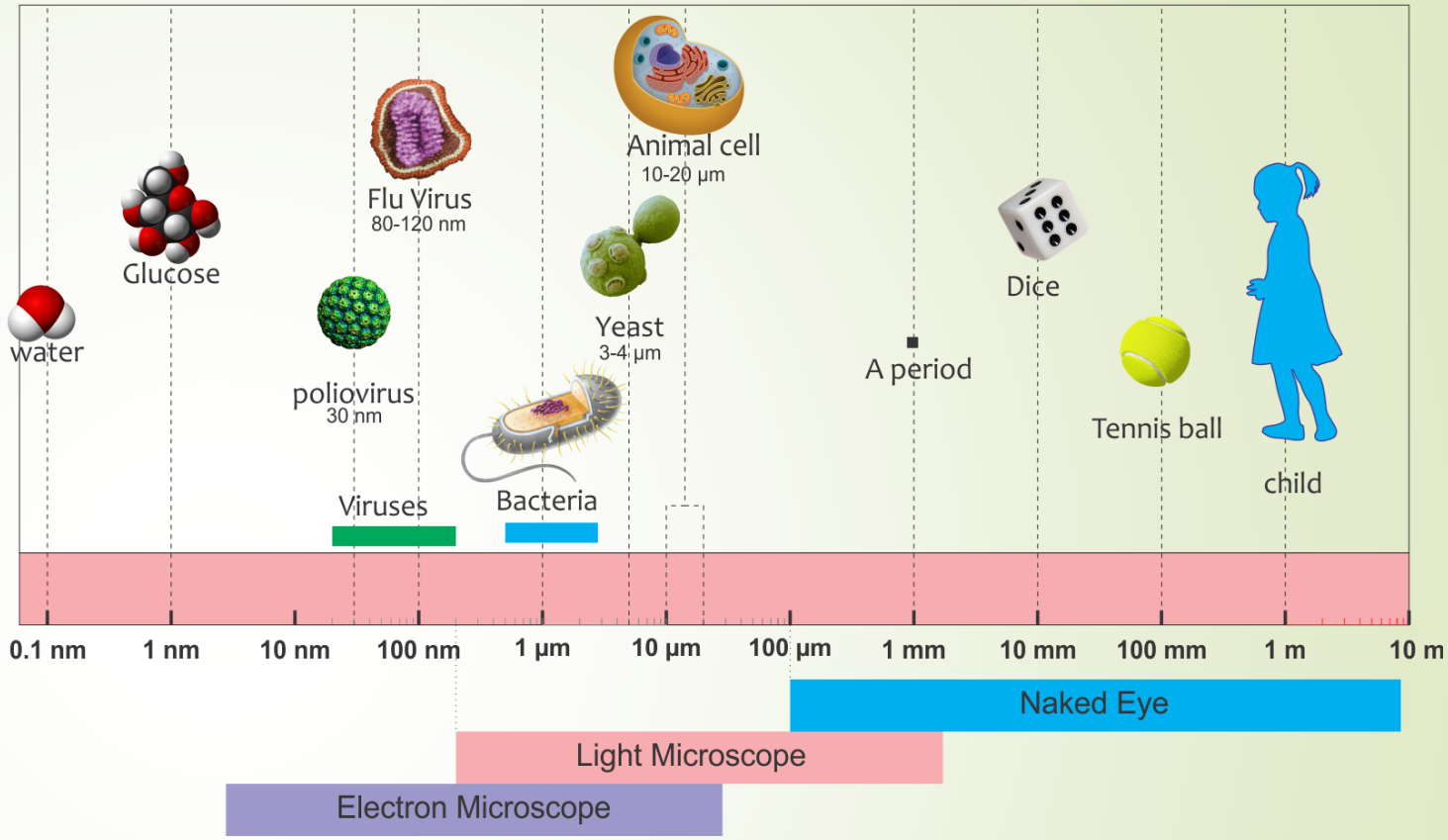
- Microbiology is the science that deals with microorganisms.
- The word *microbiology* is *derived* from the Greek:
  - mikros = small
  - bios = life
  - logos = science.

Microorganisms

Microorganisms are small living organisms that can not be seen by naked eye except by microscope.

- An object must measure about 100 micrometers (μm) to be visible without a microscope.
- Note that fungi (yeast), bacteria and viruses are outside the range of vision of naked eye.

[1 μm = 0.001 mm]



Relative sizes on a logarithmic scale, from 0.1 nm to 1 m.

This picture shows the tip of a surgical needle (shown in purple) contaminated with bacteria (shown in yellow).

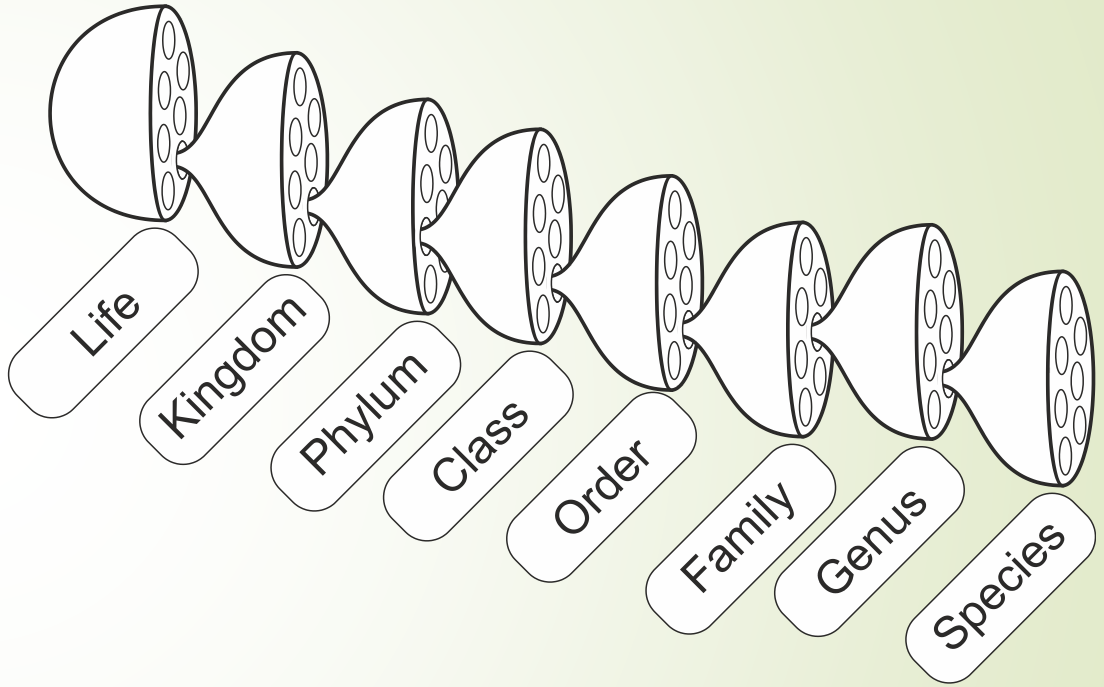
Taxonomy and Nomenclature

- **Taxonomy** is the science of classifying organisms.
- **Taxon** - group of organisms in a classification system (plural : taxa).
- **Nomenclature** is system of assigning scientific names to organisms and groups (taxa).

Taxonomic Ranks

There are seven main taxonomic ranks:

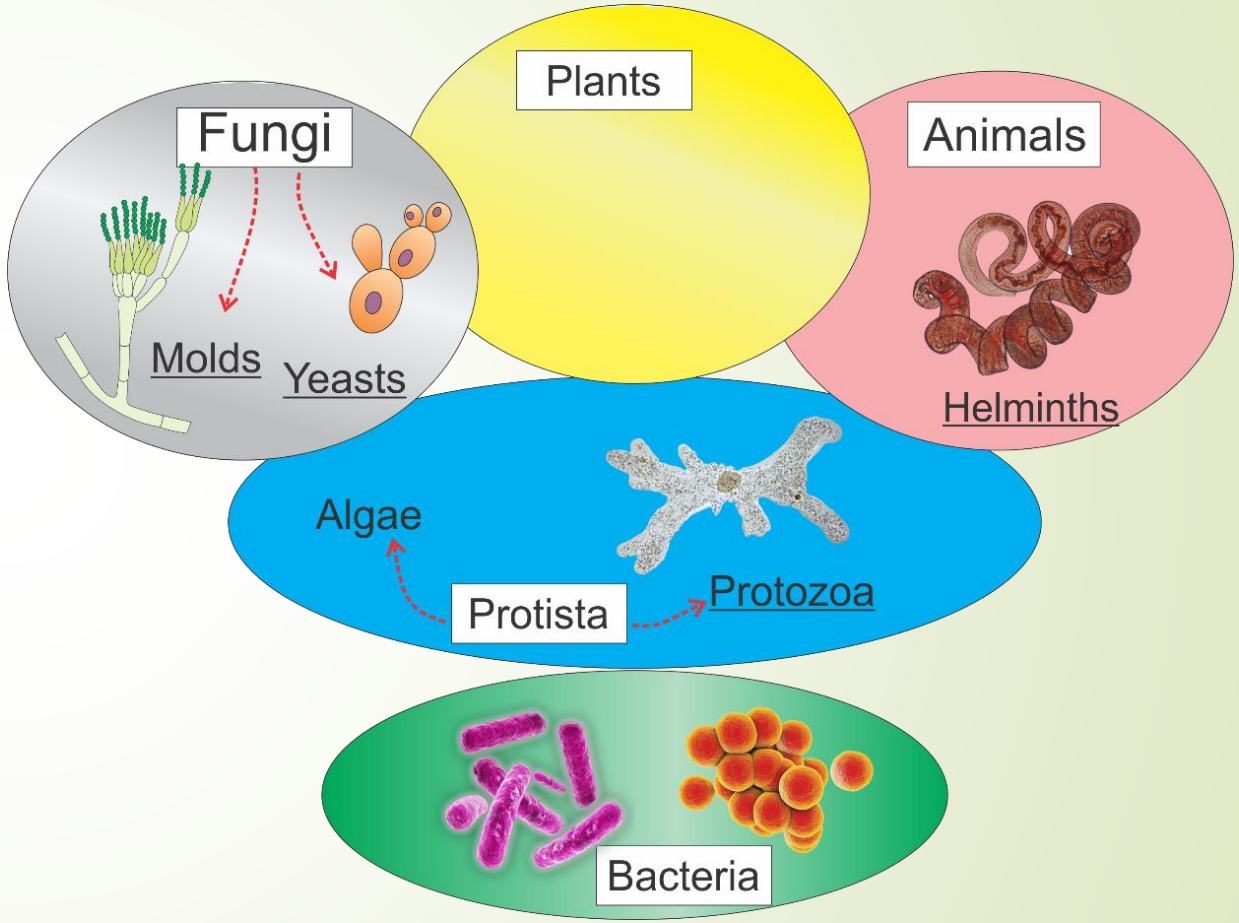
- **Kingdom**
- **Phylum**
- **Class**
- **Order**
- **Family**
- **Genus**
- **Species**



The Five Kingdoms of Life

Biologists generally classify living organisms into one of the five kingdoms illustrated here:

- Fungi
- Plants
- Animals
- Protista (includes Algae and Protozoa)
- Bacteria (Monera)



The Binomial nomenclature

- Binomial nomenclature is the formal system of naming species.
- Each organism name has two parts, the genus name and the species name.

Example:

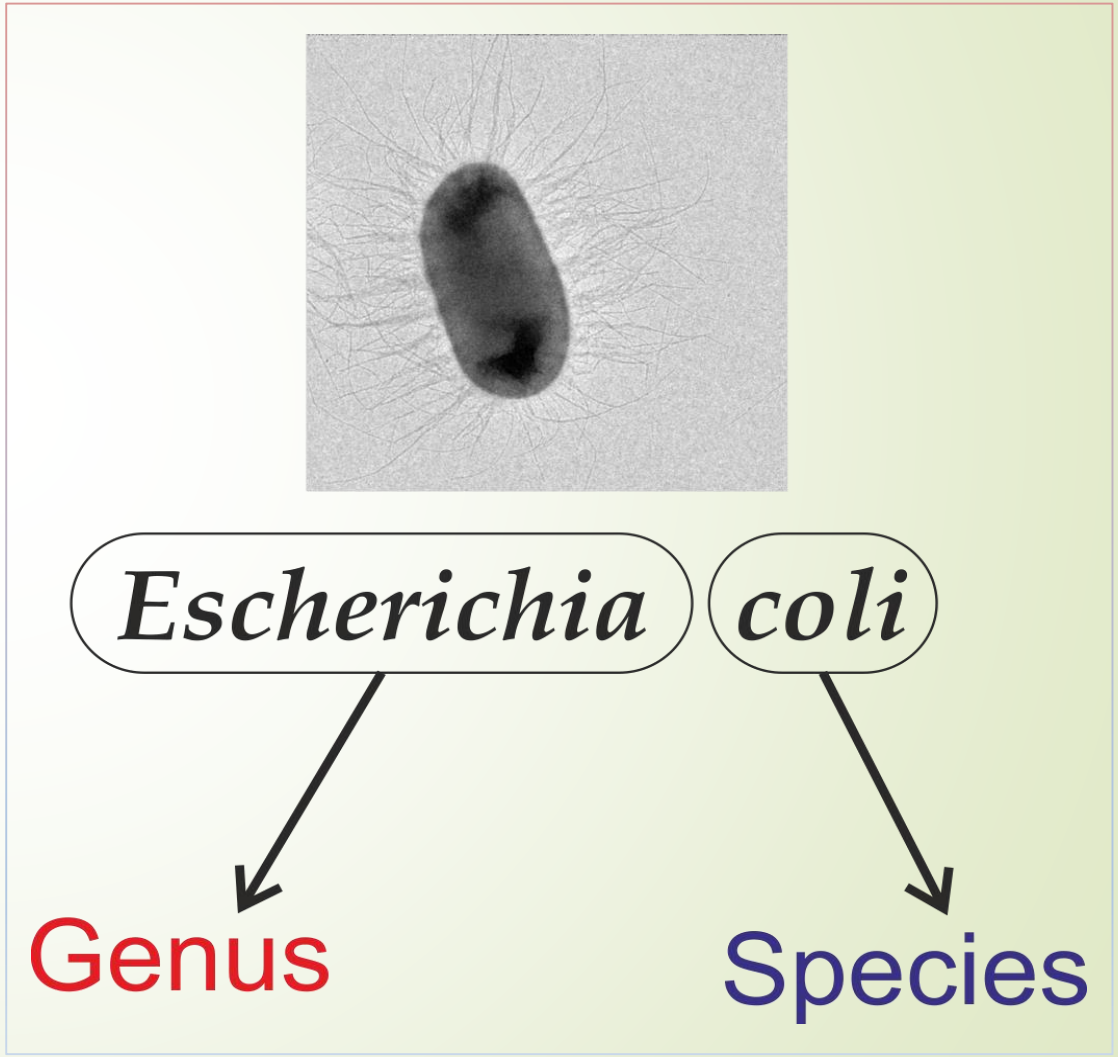
Staphylococcus aureus

Genus

Species

Example of binomial nomenclature

Escherichia coli is a common commensal intestinal bacterium.



The Binomial nomenclature

- The first letter of the genus name is always **CAPITALIZED**.
- The first letter of the species name is **not** capitalized.
- Both genus and species names are ***italicized***.

Staphylococcus aureus

Genus

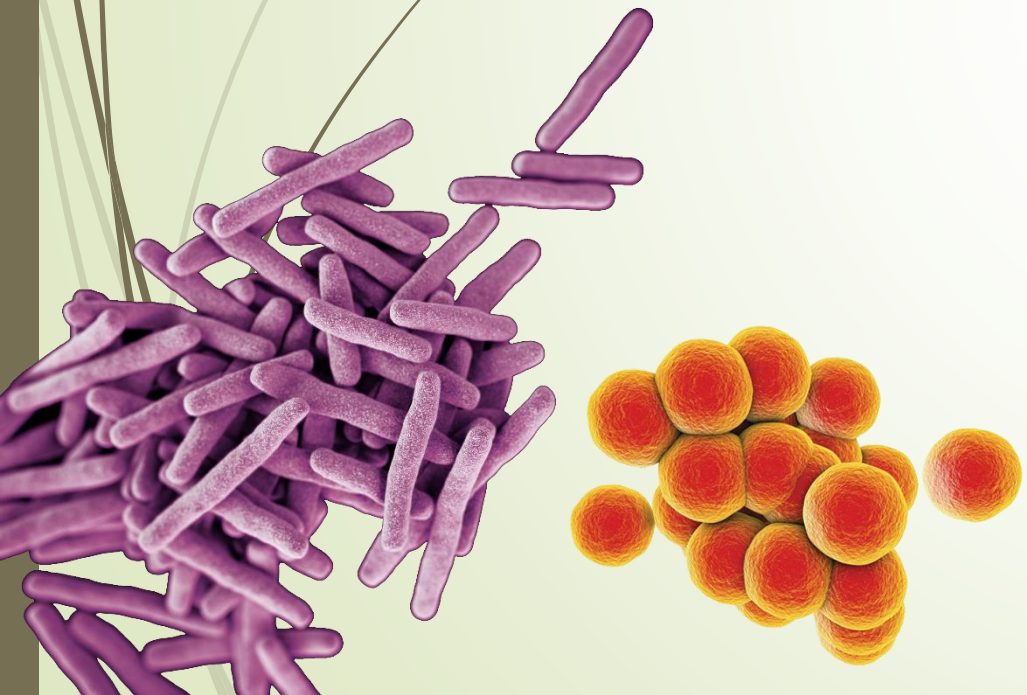
Species

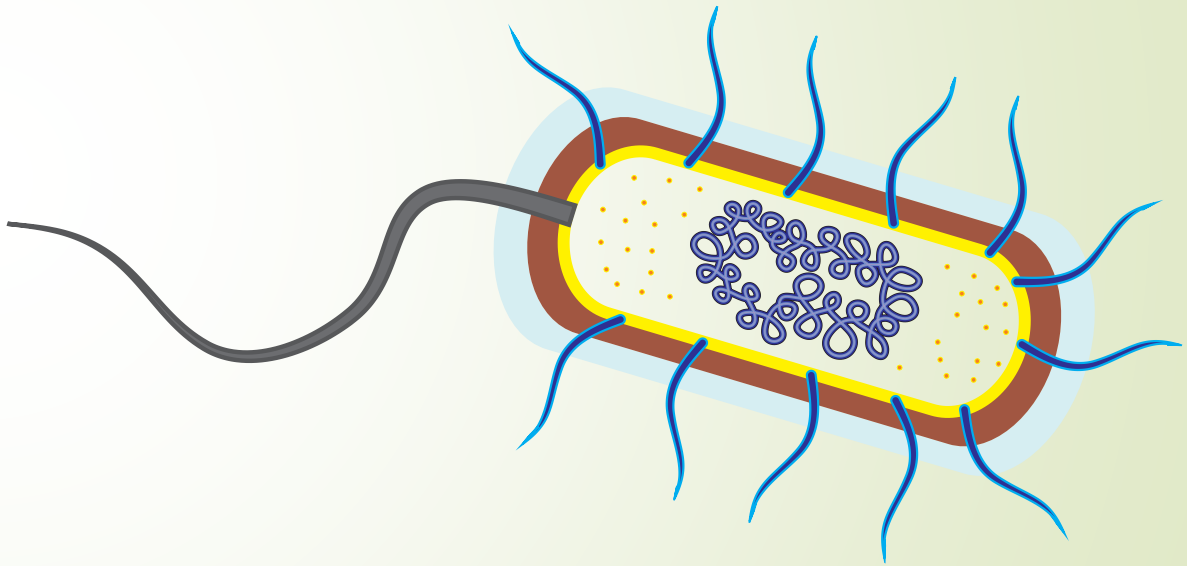
Eukaryotes and prokaryotes

There are two major divisions of cellular organisms: **eukaryotes** and **prokaryotes**.

Prokaryotes

- Cells with primitive nucleus (single naked chromosome without nuclear membrane)
- Example → bacteria.

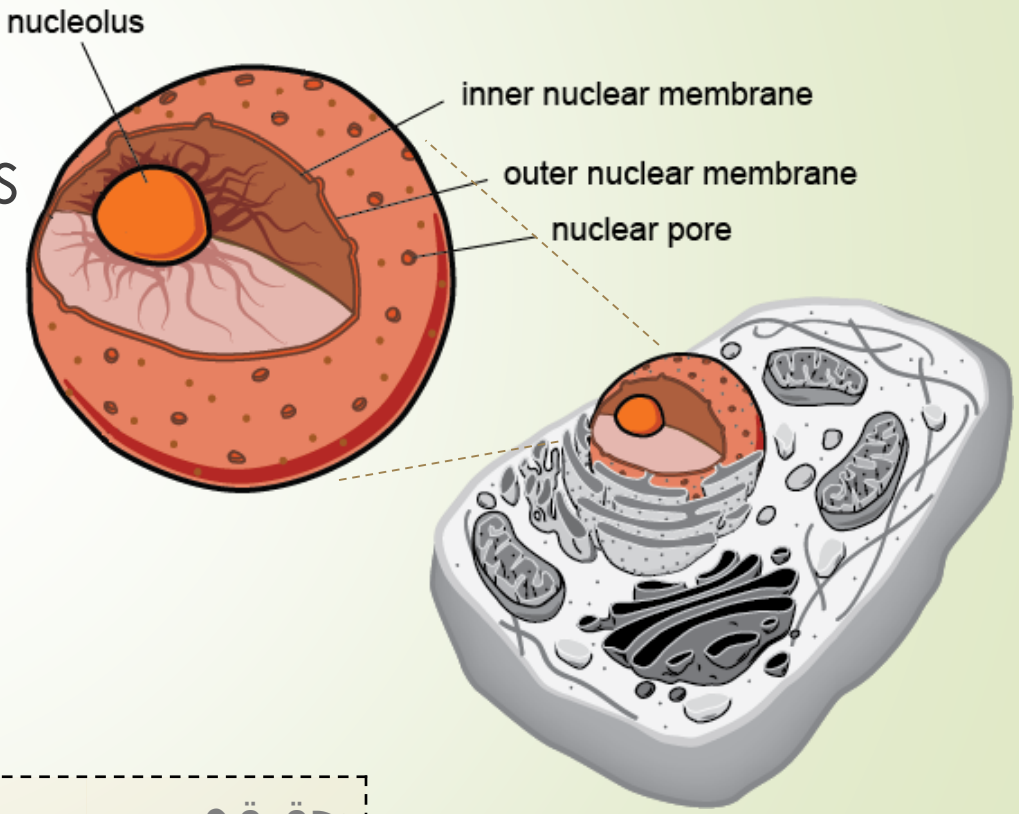




Pro	: premature or primitive	بدائي
Karyon	: nucleus	نواة

Eukaryotes

Cells with **true nucleus** which contain a nuclear membrane, nucleoli, and multiple chromosomes within the nucleus.



Example:

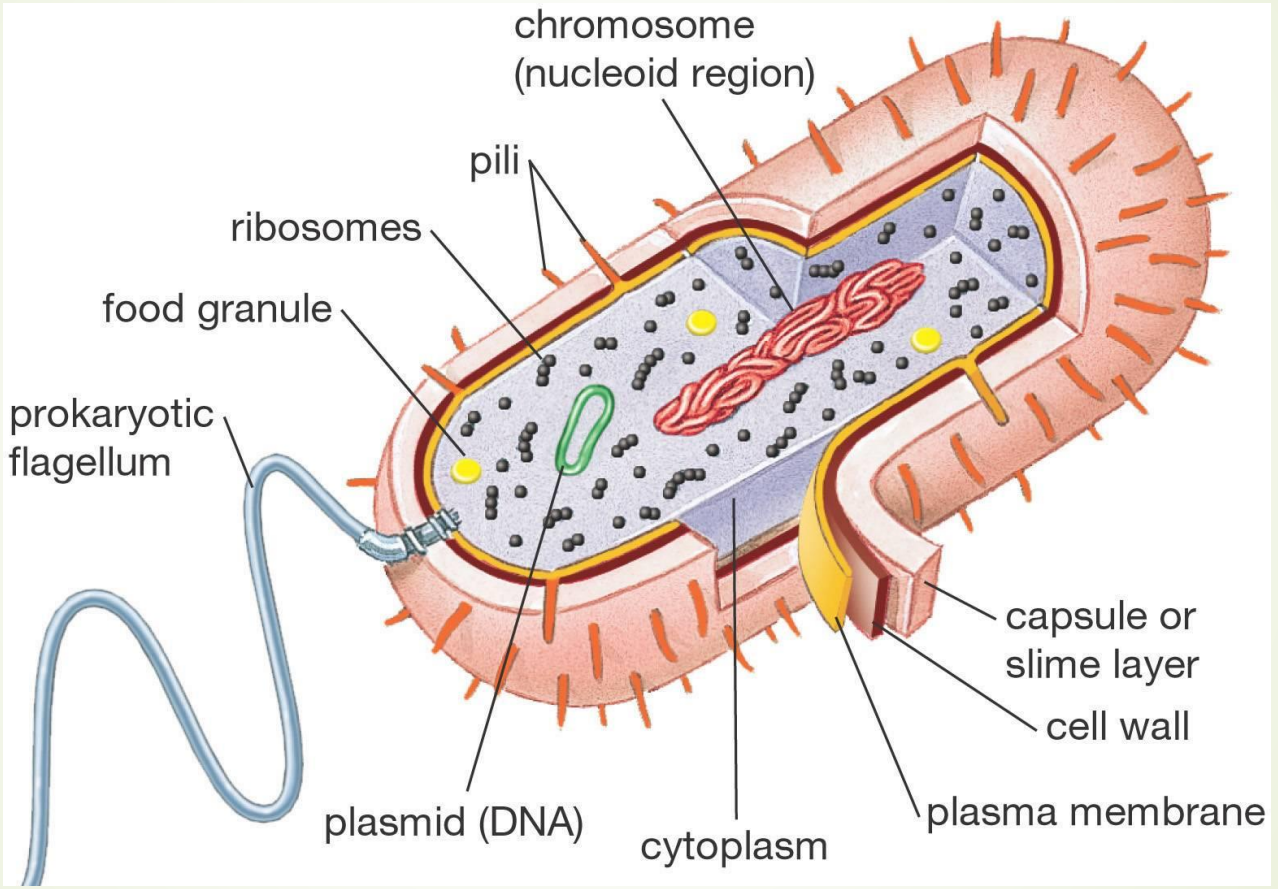
- Fungi, protozoa.
- Animal and plant cells.

eu	: true	حقيقي
Karyon	: nucleus	نواة

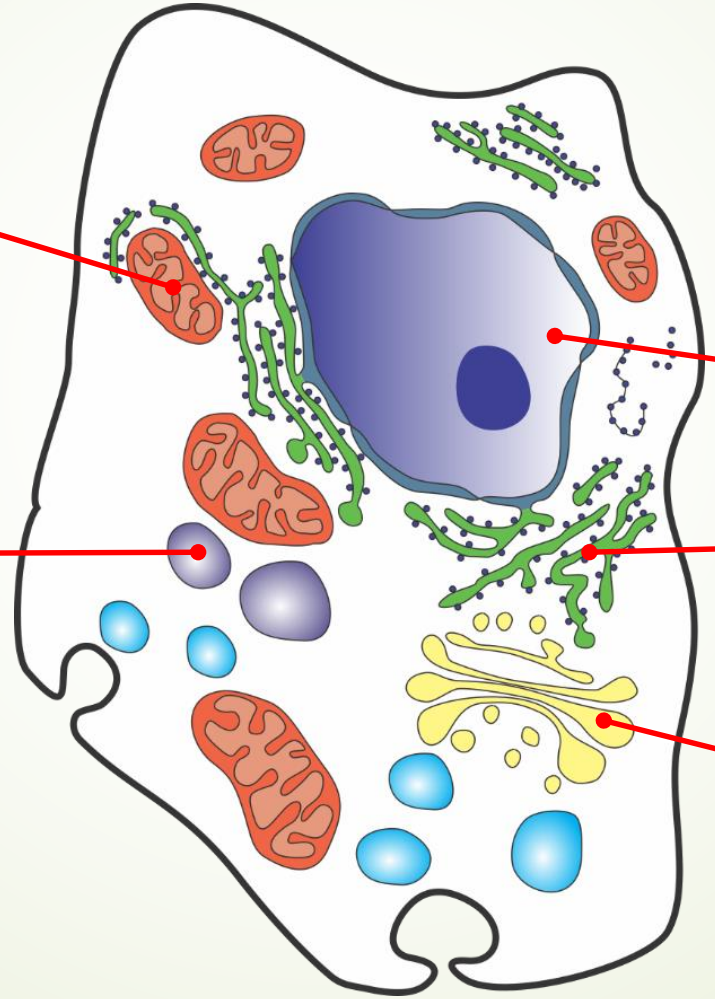
Differences between prokaryotic and eukaryotic cells

	Prokaryotic cell	Eukaryotic cell
Cell Size	Smaller	Larger
Nucleus	- No nuclear envelope (membrane) - Single circular chromosome	-Nuclear envelope (membrane) is present -Multiple linear chromosomes.
Membrane-bound organelles	Not present	-Present -Examples: mitochondria, Golgi apparatus, endoplasmic reticulum.
Ribosome	Smaller (70S)	Larger (80S)
Cell wall	-Present -Based on peptidoglycan	-Present or absent -When present, based on cellulose (plants) or chitin (Fungi)
Division	Simple binary fission (SBF)	Mitosis or meiosis
Example	-Bacteria	-Fungi -Protozoa

A Prokaryotic cell



A Eukaryotic cell (Animal cell)



Mitochondria

Lysosome

Nucleus

Rough endoplasmic reticulum

Golgi apparatus

Major groups of human pathogens:

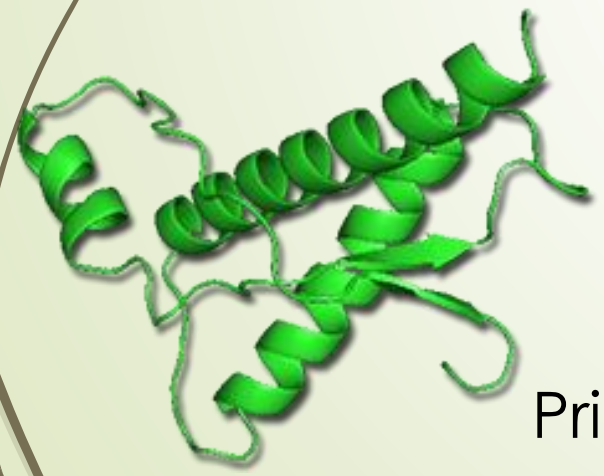
There are six types of infectious agents:

1. Bacteria,
2. Fungi,
3. Protozoa,
4. Helminths,
5. Viruses,
6. Prions

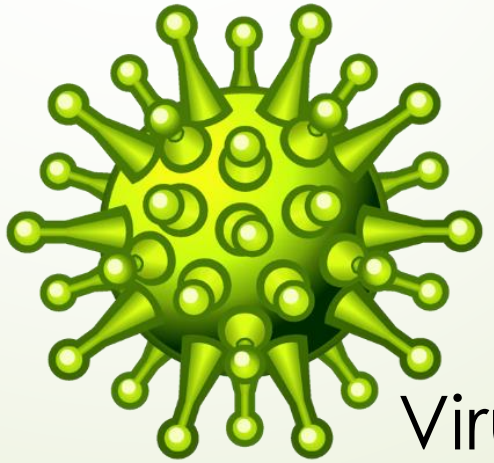
Acellular infectious agents

Viruses and prions are not composed of cells, they are subcellular or acellular infectious agents:

- **Prions** lack nucleic acid and consist only of proteinaceous infectious particles.
- **Viruses** are not cells but can replicate only within cells.



Prion

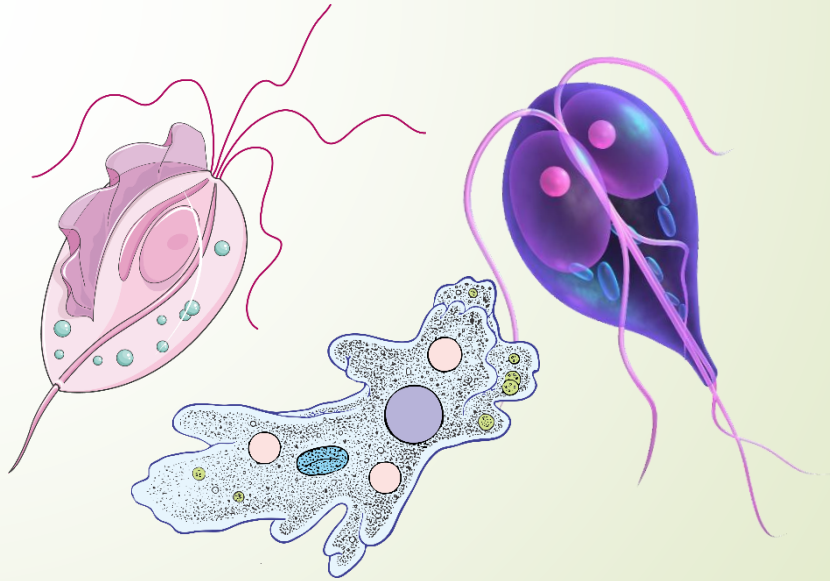


Virus

Parasites

- **<u>Protozoa and helminthes</u>** are commonly called **parasites**.
- They are studied in **parasitology**.

Helminths

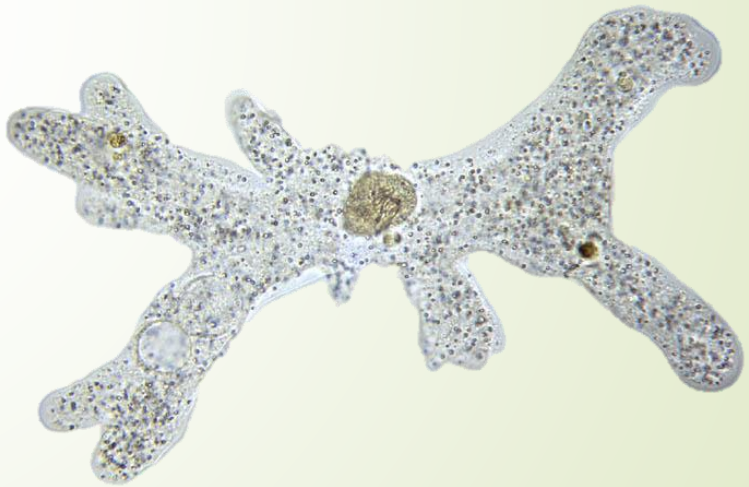


Protozoa

Parasites

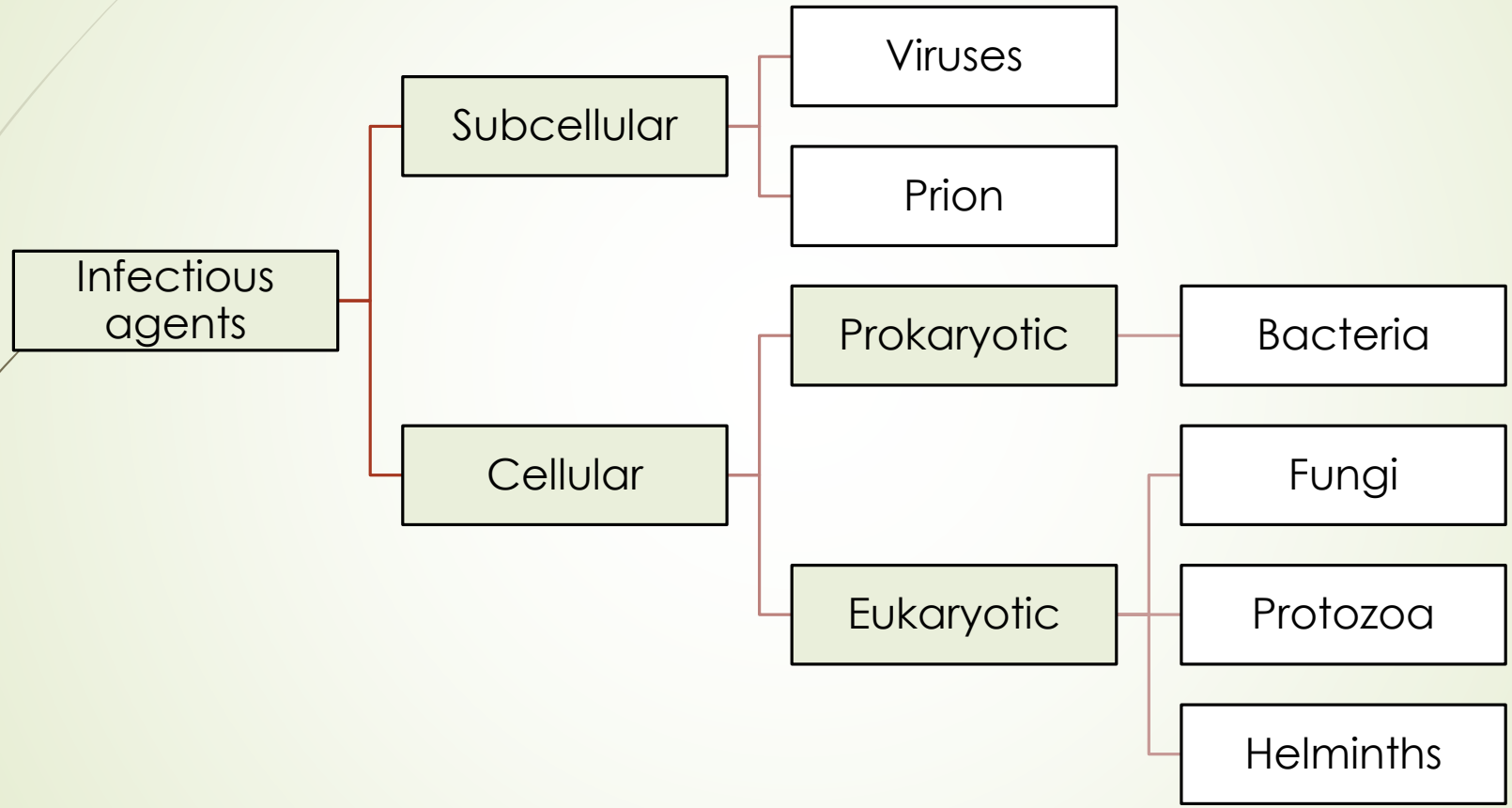
- **Amoeba** is an example of infectious protozoa.
- **Ascaris** is an example of infectious helminths.

Ascaris



Amoeba

Major groups of human pathogens



Quizzes


1. Features of prokaryotes includes:

A. No nuclear membrane.

B. No membrane bound organelles.

C. Divide by simple binary fission

D. Contain single circular chromosome

E. All of the above


2. In the binomial nomenclature organism name is composed of ____ and _____?

A. Family and species
B. Family and genus
C. Genus and species
D. Class and family


3. Cells with a true nucleus are called:

A. Prokaryotes

C. Eukaryotes

D. Viruses


4. Which of the following microorganisms has a true nucleus:

A. Viruses
B. Fungi
C. Prions
D. Bacteria

5. The infectious agent that is composed of protein but lack nucleic acid is:

A. Viruses
B. Fungi
C. Prions
D. Bacteria

6. Which of the following is subcellular

A. Fungi
B. Prion
C. Bacteria
D. Protozoa


7. Subcellular infectious agents include:

1) .....

2) .....


8. Which of the following is Eukaryotic

A. Fungi
B. Prion
C. Bacteria
D. Viruses

9. Which of the following is Prokaryotic

A. Fungi
B. Prion
C. Bacteria
D. Viruses


10. Eukaryotic infectious agents include:

1) .....

2) .....



11. True or false:

1. Microbiology is science that deals with bacteria.
2. Prokaryotic cells has membrane bound organelles such as mitochondria
3. Eukaryotic cells has 70S ribosomes
4. In the binomial nomenclature every organism name has two parts, the family name and the genus name.