1st Tutorial session's correction

Part 1: Key concepts

1. The two major cellular structures that divide the living world are:
   - ✓ **Prokaryotic cells** (lacking a membrane-bound nucleus, e.g., *Bacteria* and *Archaea*).
   - ✓ **Eukaryotic cells** (possessing a membrane-bound nucleus and organelles, e.g., Fungi, Protozoa, Algae).
2. Three major characteristics of prokaryotes:
   - ✓ Absence of a membrane-bound nucleus (DNA is free in the cytoplasm).
   - ✓ Absence of membrane-bound organelles (mitochondria, endoplasmic reticulum, etc.).
   - ✓ Generally small size (0.5 - 5 µm) and simpler cellular structure.
3. Groups considered acellular: **Viruses**
   - **Why?** They lack cellular organization (no cytoplasm, no independent metabolism) and can only replicate by hijacking the machinery of a host cell.
4. Examples of microbial impacts:
   - ✓ **Positive:** Lactic acid bacteria (*Lactobacillus*) are used in yogurt production and promote gut health.
   - ✓ **Negative:** *Mycobacterium tuberculosis* causes tuberculosis, a serious respiratory disease in humans.

Part 2: Application exercises

Exercise 1: Classify these microorganisms

Organism	A - Cellular Type	B - Main Group	C - Key Characteristic or Role
Escherichia coli	Prokaryote	Bacterium	Model organism, gut inhabitant
Influenza virus	Acellular	Virus	Causes the flu, obligate parasite
Saccharomyces cerevisiae	Eukaryote	Fungus (Yeast)	Baker's yeast, fermentation.
Methanobrevibacter smithii	Prokaryote	Archaea	Methanogenic archaeon, produces methane in the human gut microbiome.
Paramecium caudatum	Eukaryote	Protozoan	Ciliated protozoan, moves via ciliary beating
Penicillium camemberti	Eukaryote	Fungus (Mold)	Mold used in the ripening of Camembert
Trypanosoma brucei	Eukaryote	Protozoan	Causative agent of African sleeping sickness, transmitted by the tsetse fly.
Penicillium notatum	Eukaryote	Fungus (Mold)	Original source of the antibiotic penicillin.
Euglena gracilis	Eukaryote	Protist / Microscopic Algae	Photosynthetic, possesses a flagellum

Note: *Euglena* is often classified as a Protist or a Microscopic Algae due to its chloroplasts and photosynthetic ability.

Exercise 2: Complete the comparative table

Characteristic	Prokaryotic cell (Typical Bacterium)	Eukaryotic cell (e.g., Yeast)
Membrane-bound nucleus	Absent	Present
Circular "naked" DNA in the cytosol	Present	Absent (Linear DNA within the nucleus)
Cell wall	Present (contains peptidoglycan)	Variable (Present in fungi, plants)
Mitochondria	Absent	Present
Membrane-bound organelles (ER, Golgi...)	Absent	Present

Exercise 3: Case Study

1. Is this microorganism prokaryotic or eukaryotic? Justify.

- It is **prokaryotic** because it lacks a membrane-bound nucleus and its size (~1 µm) is characteristic of prokaryotes.

2. To which major domain of life does it most likely belong? Justify with two arguments.

- It most likely belongs to the domain ***Archaea***.

Arguments:

- Biochemical: Its cell wall contains pseudomurein, not the peptidoglycan found in *Bacteria*.
- Metabolic and ecological: It performs methanogenesis, a metabolism unique to some *Archaea*. This, combined with its isolation from a high-temperature (90°C) vent, is typical of archaeal extremophiles.