Introduction The classification of the living world, also known as taxonomy, is a science that aims to organize and categorize living organisms into hierarchical groups based on their common characteristics.o Regardless of their form, size, specialization, and lifestyle, all living cells (Eukaryotes or Prokaryotes) exhibit a fundamental structure characterized by the presence of the following three elements: 1- Cell membrane or plasma membrane, without which intracellular biomolecules would be diluted in the surrounding environment.o Ecological Importance: Prokaryotes play a crucial role in terrestrial and marine ecosystems as decomposers, nitrogen fixers, producers of greenhouse gases, and perform various other functions.Here are the main hierarchical levels in biological classification 1- Domain: The three domains of life are as follows: o Archaea (archaea) o Bacteria (bacteria) o Eukaryota (eukaryotes) 2-Kingdom: Each domain is divided into kingdoms.For example, the domain of eukaryotes is subdivided into several kingdoms, including: o Animalia (animals) o Plantae (plants) o Fungi (fungi) o Protista (protists) 3- Phylum: Phyla are even more specific groups within kingdoms.I- Prokaryote In biology and taxonomy, a prokaryotic cell (from the Latin pro, meaning 'before,' and the Greek karyon, meaning 'nucleus') is a unicellular organism (1 to 10um) lacking a nucleus and intracellular organelles (except for ribosomes).Morphology of some bacterial cells (a)Bacillus megaterium; (b)Tetracoccus canadensis Staphylococcus aureus Constant structures: Constant structures are mandatory organelles found in all bacteria.3- Cytoplasm: the region between the nucleus (or DNA) and the cell membrane o The prokaryotes are unicellular organisms belonging to the kingdoms of bacteria and archaea.5- Cytoplasmic Inclusions: This includes reserve granules or gas vacuoles, allowing the vertical movement of the bacterium that contains them.Traditional classification relies on systematic approaches, which encompass nomenclature (naming) and phylogeny (reconstruction of evolutionary relationships).4-Pili (Fimbriae): Similar to flagella but shorter, pili are membranous extensions that facilitate the adhesion of bacteria to substrates.The cell The cell (from the Latin cellula, meaning small chamber or room) is a compartment partitioned (a closed structure) by a biomembrane containing genetic material plus a viscous fluid called cytoplasm.o Reproduction: Prokaryotes primarily reproduce through binary fission, a process where a mother cell divides into two genetically identical daughter cells.The constant structures are: 1- Nucleoid Material: This is the bacterial chromosome, composed of a single double-stranded circular DNA molecule of approximately 1mm.They encode for the synthesis of various enzymes that enable the bacterium to utilize certain substrates or resist antibiotics.o Archaebacteria are typically found in extreme environments (they are also called extremophiles), such as hot springs (~100?C), the deep ocean floor, salt-saturated waters and other environments previously thought to be inhospitable to life.For instance, in the animal kingdom, arthropods (such as insects and arachnids) and chordates (such as vertebrates) are two distinct phyla.o Horizontal Gene Transfer: Prokaryotes can exchange DNA fragments through conjugation, transformation, and transduction, promoting genetic diversity.o Resistance: Some prokaryotes develop resistance to antibiotics and harsh environmental conditions through mechanisms such as mutation and plasmid transfer.The ultrastructure of the cell wall subdivides bacteria into two main groups : o Gram-positive bacteria : their wall is dense and composed of thick peptidoglycan.Their walls consist of a thin layer of peptidoglycan resting on the plasma membrane, surrounded by an outer membrane, making a total of three layers.A pertinent example would be

Escherichia coli.Bacteria replicate rapidly through cell division or binary fission.2–Mesosomes: Exclusive to aerobic bacteria, mesosomes are membranous invaginations that penetrate the cytoplasm.Flagella are composed of a contractile protein known as flagellin, and they facilitate the bacterium's locomotion.Taxonomy is an essential tool for biologists and ecologists because it allows them to understand the relationships between organisms and study the evolution of life on Earth.The cell represents the structural, functional, and reproductive unit constituting all (bacteria) or part of a living organism (animal or plant).o Absence of Organelles: Prokaryotes lack membrane-bound organelles such as mitochondria or chloroplasts, which are found in eukaryotes.3–Flagella: These are mobile membranous extensions, ranging from 1 to 8, located in different positions.Figure: Bacterial Cell Structure o The prokaryotes are divided into two major taxonomic groups, EUBACTERIA and ARCHAEBACTERIA.The origins of this group and its relationship with eubacteria and eukaryotes are currently hotly debated among microbiologists.A species is defined as a group of individuals capable of reproducing with each other and producing fertile offspring.2- Region containing genetic material, located inside the cell with molecules capable of reading and copying hereditary instructions.The flagellum and certain pili are involved in locomotion, fimbriae allow the cell to adhere to a substrate, and sex pili are used for DNA exchange.Domain of bacteria A bacterium is a unicellular prokaryotic organism of very small size (1 to 10um).They have various shapes, such as rod-shaped, spherical, cylindrical, etc.4–The cell wall: Thick, ranging from 20 to 80 nm, it externally delimits the bacterium and determines its shape.Gram-positive bacteria retain the dye, appearing violet in color.Their cell walls have a single layer of peptidoglycan resting on the plasma membrane, and both together constitute the cell wall.Gram-negative bacteria are much more permeable to the dye, resulting in a pink coloration.For instance, in the class of mammals, the order of primates includes monkeys, chimpanzees, and humans.7- Genus: 8- Species: It's important to note that the classification of the living world is constantly evolving as new genetic and anatomical information is discovered.o Lack of Nucleus: Unlike eukaryotes, prokaryotes do not have a nucleus enclosed by a membrane.Bacteria reproduce through binary fission or constriction.The bacterial cell is composed of both constant (essential) and variable structures.It is free in the cytoplasm, not separated by a nuclear envelope to form a true nucleus, hence the name Prokaryote.2–Ribosomes: Grouped in clusters forming polyribosomes.3–Plasma Membrane: Composed of lipids and proteins.o Gram-negative bacteria : their wall is composed of a loose peptidoglycan layer.They are found in certain groups and are absent in others, depending on the species and their environments.They contain enzymes of the respiratory chain, thus serving a role similar to that of mitochondria.o They can metabolize unusual substances like methane, sulfur, and hydrogen gas.The classification of the living world includes several levels, ranging from the most general to the most specific.For example, in the phylum of chordates, the class of mammals is a group that includes animals like humans, dogs, and cats.5- Order: 6- Family: o Families are even more restricted groups, grouping species that are very similar.o Genuses are very close groups, grouping very similar species.They also sometimes contain smaller circular DNA elements called plasmids.The DNA is located in a region known as the nucleoid, which is not surrounded by a membrane.o Diverse Metabolism: Prokaryotes exhibit diverse metabolism.They can be aerobic (using oxygen) or anaerobic (thriving in the absence of

oxygen).Some are autotrophic (producing their own food), while others are heterotrophic (obtaining their food from the environment).Bacteria can live individually or grouped in colonies.A living and functional bacterial cell cannot be devoid of any of these organelles.Examples of Gram-positive bacteria include staphylococus.Optional Structures: Optional structures are organelles that may or may not be present in the bacterium.These include: 1-Capsule: Often polysaccharide or polypeptide in nature, the capsule primarily plays a protective role.Its presence is a sign of virulence as it shields the bacterium from phagocytosis.6- Plasmids: Plasmids are double-stranded circular DNA fragments.A plasmid can be present in multiple copies within a single bacterial cell.o As of now, no pathogenic strain of archaebacteria has been identified.Many also have a capsule or slimy envelope made of polysaccharides.o Prokaryotes often have appendages (protrusions) on their surface.o Most prokaryotic cells have a single circular chromosome.It does not contain cholesterol and is low in carbohydrates.It is separated from the plasma membrane by the periplasmic space.They are composed of a protein called pilin.They are extrachromosomal and located in the cytoplasm.However, some of their characteristics place them closer to eukaryotes than eubacteria.4- Class: o Classes group similar animals or plants within a phylum.o This is the lowest level of classification.o Prokaryotic cells are much smaller than eukaryotic cells, o All prokaryotic cells are surrounded by a cell wall.Their synthesis does not require the presence of a nucleolus.It facilitates the transport of nutrients.Eubacteria are the most common forms of bacteria.o Orders are even more specific groups within classes.Its DNA is in the form of a circle or helix.For example, a bacterium.It plays a protective role: a bacterium without a cell wall dies.They can be either pathogenic or non-pathogenic.