prokaryotic vs eukaryotic cells

PROKARYOTE	EUKARYOTE	BOTH
Tiny (≈ 0.2 - 10 µm)	Bigger (≈ 10 - 100 µm)	Ribosomes
No membrane bound organelles	Has membrane bound organelles	DNA
Division by binary fission	Division by binary fission, mitosis or meiosis	Cell membrane
Cell wall with peptidoglycan	Cell wall with cellulose (plants) or chitin (fungus)	Cytoplasm
DNA in nucleoid (no nuclear membrane)	DNA in nucleus (with nuclear membrane)	Essential functions of life
Flagella rotates	Flagella moves laterally	
DNA is circular and naked	DNA is linear and associated with histone proteins	
Smaller 70s ribosomes	Larger 80s ribosomes	
Can have plasmids	Does not have plasmids	

Prokaryotic DNA

Prokaryotic cell DNA can be found in two locations:

Nucleoid: main DNA of the cell. DNA is not enclosed in a membrane (found freely cytoplasm) DNA is a single loop DNA is not wrapped around proteins (termed “naked”)

Plasmid: extra piece(s) of DNA Circular and naked Smaller than main nucleoid DNA Replicates independently of the nucleoid DNA Not found in all prokaryotic cells Can be shared between bacteria Often contain genes for antibiotic resistance

Naked means that the DNA is not associated with proteins.

Extracellular means outside of cell

Antibiotics

Antibiotics are chemicals that kill bacteria or inhibit bacteria replication.

Antibiotics block processes that occur in prokaryotic cells but not in eukaryotic cells.

Some antibiotics damage prokaryotic DNA

Some antibiotics block prokaryotic ribosomes (70S)

Some antibiotics block bacterial cell wall synthesis

Some antibiotics block bacterial metabolism

Antibiotics block specific structures and metabolic pathways found in bacteria. Viruses do not have these structures or metabolic pathways. No cell wall No ribosomes or protein synthesis Do not replicate their own DNA (hijack the host cell replication machinery)

Functions within Prokaryote

Cell (plasma) membrane: responsible for regulating what materials move into and out of the cell

Nucleoid: DNA with ends that come together to form a circle and is NOT wrapped around proteins (termed “naked”)

Cytoplasm (cytosol): gel-like fluid substance (mostly water with many dissolved molecules), site of metabolic reactions

Ribosome: build proteins during translation

Plasmid*: extra piece(s) of small, circular DNA that can be shared between bacteria, often contain genes for antibiotic resistance

Cell wall*: provides shape and allows the cell to withstand turgor pressure without bursting

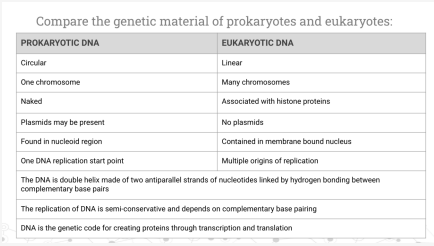
Pili*: enable the cell to attach to surfaces

Capsule*: helps the cell keep from dehydrating and adhere to surfaces

Flagellum*: Long extensions used in cell locomotion (movement)

* Structure is found in SOME but not ALL prokaryotic cells.

Genetic Material



Compare the genetic material of prokaryotes and eukaryotes:

PROKARYOTIC DNA	EUKARYOTIC DNA
Circular	Linear
One chromosome	Many chromosomes
Naked	Associated with histone proteins
Plasmids may be present	No plasmids
Found in nucleoid region	Contained in membrane bound nucleus
One DNA replication start point	Multiple origins of replication
The DNA is double helix made of two antiparallel strands of nucleotides linked by hydrogen bonding between complementary base pairs	
The replication of DNA is semi-conservative and depends on complementary base pairing	
DNA is the genetic code for creating proteins through transcription and translation	

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Binary Fission

Reproduction is one of the functions of life.

Asexual reproduction is a type of reproduction in which: Offspring arise from a single parent cell or organism The offspring are genetically identical to the parent

Binary fission and mitosis are mechanisms of asexual reproduction.

1. Prepare for Division The parent cell must have enough energy and resources in order to divide.

2. DNA Replication The replication of the circular DNA is semi- conservative and depends on complementary base pairing. Plasmid replicates separately.

3. DNA Attachment The two DNA molecules each attach to a different part of the cell membrane. Cell Growth The cell builds more membrane and wall, elongating the cell

4. Pinching In The cell membrane and wall continue to grow and begin to pinch inwards, creating furrows in the cell edge.

5. Division The cell membrane and wall continue to grow, with the two furrows eventually meeting (called a septum) to separate the cell into two.

6. Daughter Cells The two daughter cells that result from binary fission are genetically identical to the single cell from which they arose.

Ribosomes

In both prokaryotes and eukaryotes, ribosomes... catalyzes the synthesis (creation) of proteins are composed of two subunits that come together to form a functioning structure.

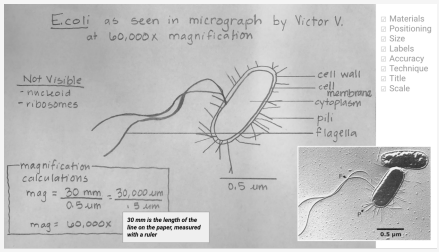
Prokaryotes have smaller (70s) ribosomes.

Eukaryotes have larger (80s) ribosomes.

Micrographs

Ultrastructures are cellular structures that are too small to be seen with a light microscope. Since prokaryotic cells are so small, any detail requires an electron microscope to be seen.

E. Coli



E. Coli

Drawing should include

Cell wall – uniformly thick and drawn outside the plasma membrane; Capsule – drawn outside the cell wall; Plasma / cell membrane – drawn as a continuous single line; Cytoplasm; Ribosome – drawn as a small circle or dark dot; Nucleoid- shown as a tangle of thread or irregular shape without a nuclear membrane; Flagella – shown to be longer than any pili; Pili - hair like structures Plasmid – circular ring of DNA; Size stated -- 1 to 10 µm

Florey and Chain

Florey and Chain were the scientists who followed up most successfully on Alexander Fleming's discovery of penicillin, sharing with him the 1945 Nobel Prize in Physiology or Medicine.

Tested the antibacterial properties of penicillin on mice. 8 mice were injected with disease causing Streptococci (infectious bacteria) 4 of these were then injected with penicillin, the other 4 were not 16 hours later, the 4 mice that had received penicillin were alive, but the untreated mice were dead.

Research Risks

Then	Now
tested humans without consent, no protocols or rules to follow, impure drug sample, rushed, fast testing trial, patients at the point of death	testing humans not allowed without consent, strict protocols, highly purified drug samples, drug testing, healthy people often tested before they get sick

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