

1 Introduction to Cells, Diversity and Nucleic Acids

1.1 Prokaryotic and Eukaryotic Cells

1.1.1 Prokaryotic Cells

Definition. Prokaryotic cells:

- No Nuclei
- Single-celled (mostly)

e.g. eubacteria (inc. bacteria), archaea (more extreme environments)

Capsule: a polysaccharide layer for protection from engulfment by eukaryotic cells (optional)

Cell wall: tough protective outer coat (optional)

DNA in a nucleoid: compact structure of DNA and proteins

Ribosome: making protein

Bacterial flagellum: locomotion (optional)

Pilus: sexual conjugation, locomotion (optional)

Cytoplasm: fluid inside the cell

1.1.2 Eukaryotic Cells

Definition. Eukaryotic cells:

- Nuclei
- Single-celled or multicellular

e.g. plants, fungi, animals

Typically 1000 times larger in volume \Rightarrow have cytoskeleton

Mitochondria: power cell (produces ATP)

Question. What is the difference between nucleoid and nucleus?

When comparing plants to animal cells, plants have a cell wall (animals don't), chloroplasts (animals don't), vacuoles (animals don't).

Cell wall: tough protective coat

Chloroplasts: photosynthesis

Vacuoles: Type I – storage, Type II – animal lysosome in degradation

Endosymbiotic Theory: Did eukaryotes evolve from prokaryotes?

1.2 Origins of Eukaryotes

Not all prokaryotes have non-enclosed internal membranes (some do), but most eukaryotes do, most of them enclosed.

Prokaryotes originally could not use oxygen (did not have mitochondria).

Prokaryotes with internal membrane could engulf particles.

Ancient symbiosis was formed: ATP from mitochondria (free living aerobic prokaryotes able to use oxygen to generate ATP) for protection from prokaryotes.

Chloroplasts are also thought to evolve the same way.

Mitochondria and chloroplasts have their own DNA, RNA, ribosomes and proteins. In addition, they would have a double membrane (two phospholipid bilayers). Even today there are carnivorous single-celled eukaryotes (eg Didinium, Neutrophils).