Importance and structure of the prokaryotic chromosomes

The prokaryotic genome usually consists of a single chromosome and plasmids. Eukaryotes, on the other hand, contain a large number of chromosomes – nuclear, non–nuclear (mitochondrial), and sometimes plasmids.

Most of what we know about prokaryotic chromosomes has been obtained from Escherichia coli studies – it is the organism of choice for similar prokaryotic research. A chromosome is made up of double-stranded circular DNA. Prokaryotes do not contain a nucleus or other membrane-bounded organelles. The word "prokaryote" actually means "in front of the nucleus." The chromosome is stored in a special area called a nucleoid.

The prokaryotic genome is often significantly larger than the cell itself. So how is it possible for genetic information to fit into a cell? Eukaryotes solve this problem by wrapping DNA around histones. However, prokaryotes do not contain histones (a few exceptions exist). The prokaryote compresses its DNA by supercoiling the strand into small rolls [1] (http://www.nature.com/scitable/topicpage/genome-packaging-in-prokaryotes-the-circular-chromosome-9113). The fibers twist so tightly that they ultimately overlap and form one large condensed sphere. It distinguishes between two types of packaging – positive (DNA turns are in the same direction as the helix) or negative (DNA is twisted in the opposite direction than the helix). Most bacteria are negatively spun during normal growth.

Specific properties of prokaryotes

Prokaryotes most often reproduce asexually and are haploid (there is always only one copy of the gene). Prokaryotes often also contain several plasmids (extrachromosomally stored DNA molecule of linear or circular nature). In contrast to chromosomal DNA, they are typically smaller and encode genes that are not necessary for survival. However, they often provide a certain advantage to their wearer (e.g.: resistance to ATB, ...). Plasmid replication occurs independently of chromosome replication.

Due to the need for prokaryotes to fit all their genes into a single chromosome, there is not much space left for non-coding sequences. Although the proportion of non-coding DNA segments in eukaryotes is around 98 %, in prokaryotes it is only 12 %.

Prokaryotic chromosomes

- most prokaryotes contain a single circular chromosome
- chromosomes are stored in a nucleoid, which they can fit into by rolling the DNA strand and binding to certain proteins
- DNA that communicates with the cytoplasm allows direct attachment of transcription and translation
- contain only one copy of the gene (monoploid)
- non-essential genes tend to be stored in plasmids outside the chromosome
- the prokaryotic genome is very compact – they contain very few non-coding DNA sequences

Links

Related articles

- genome
- plasmid
- E. coli
- chromosome
- histone

External links

- Prokaryotic and eukaryotic chromosomes: what's the difference? (http://vegyeszkar2005.ch.bme.hu/Biomernoki/Mikrobialisgenetika/nemkotelezo/Drlica.pdf)

Source

- Genome Packaging in Prokaryotes (http://www.nature.com/scitable/topicpage/genome-packaging-in-prokaryotes-the-circular-chromosome-9113)

Bibliography

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