Reproduction of Bacteria

Bacteria multiply by **asexual division**, very fast. The length of one reproductive cycle is 20–150 min (the more favorable the conditions, the shorter the cycle). Reproduction is regulated by the amount of nutrients and concentrations of bacterial metabolism products. Asexual division begins with cell elongation and replication of the bacterial ring chromosome. Replication begins at the **OriC** site - the site of attachment of the chromosome to the plasma membrane. The genetic identity of clones (daughter cells) is limited by random mutations. The formation of a new section of membrane between these two attachments shifts the newly formed daughter chromosomes apart. Thus, there may be a situation where the cells move away sufficiently and a septum is formed, or the two daughter cells separate from each other - the so-called dam division.

Replication of bacterial DNA

It runs in both directions against each other, it is semi-conservative. Synthesis and repair are controlled by D**NA polymerase**. **The leader chain** runs from the 5 'to the 3' end, synthesis continuously. **The lagging chain** - the synthesis of **Okazaki fragments** - is connected together by ligase. The enzymes involved in bacterial DNA replication are:

- helicases - untangling
- topoisomerases - release tension in the resulting DNA
- gyrase - removal of excess threads

Gene expression

RNA Transcription

The DNA-dependent RNA-polymerase binds to the sigma factor in promotor.

Translation

Ribosomes are smaller and structurally different from eukaryotic ribosomes (antibiotics act selectively only on bacteria), so it is very fast - ribosomes attach immediately to unfinished mRNA

Control of gene expression

Bacteria have the ability to adapt to environmental change (intrusion into the host), which is a two-step process - sensor> activator / repressor

🔎 *For more information see Regulation of Gene Expression in Prokaryotes.*

Mutations

Bacterial mutations are point or larger changes - deletions, inversions, insertions. Many mutations lead to disruption of the metabolic pathway - **auxotroph** (does not grow on a culture medium where the product is missing). There is also the **possibility of beneficial features** - the ability to withstand bacteriophages, chemicals of ATB. Mutations are divided into spontaneous and induced mutations.

- base analogs, alkylating agents, intercalating agents
- **Ames mutagenicity test** – the more auxotrophic strains back mutated - the more they grow on the medium - the more mutagenic the medium

Plasmids

They are small, circular DNA molecules **independent** of the bacterial chromosome with separate replication. They carry several dozen genes that are not essential for the bacterium:

- **episome plasmid** - can also exist integrated into the chromosome
- **conjugative plasmid** - genes for fimbria, during conjugation they can transfer their copies to other bacteria

🔎 *For more information see Structure of bacteria, Conjugation.*

Recombination

Recombination is the interruption and reconnection of DNA with the exchange of its segments. May be:

1. Heterologous

New genes are introduced and exchanged between a pair of homologous DNA sequences. We distinguish here transposons, integrons.

Transposons

Moving within the genome and from the plasmid to the chromosome is called "jumping genes". By moving tr. certain genes can be started and stopped. They differ from the virus in that they lack a reproductive cycle, from the plasmid's inability to self-replicate and exist outside the chromosome. After incorporation - mutations, may carry stop-codons, termination sequences, promotors.

- insertion sequence - the simplest type of transposon, it carries only the gene for transponase and inverted repeats
- compound transposons - at least one gene in addition to IS, (genes for virulence factors, for resistance to ATB)

2. Homologous

Some bacteria change their properties by rearranging their own genes. We then distinguish between local inversion and gene conversion, eg in gonococci (*Neisseria gonorrhoeae*), when the antigenic composition changes, new serotypes are formed. There are a number of genes for antigens, only one is functional and the others are defective - multiplication and rearrangement of genes → a functional gene becomes defective and one of the defective ones becomes functional.

Interbacterial exchange of genetic information

1. Conjugation
2. Transformation
3. Transduction

🔎 *For more information see Parasexual processes in bacteria.*

Links

Related articles

- Bacteria
- Prokaryota
- Parasexual processes in bacteria

References

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