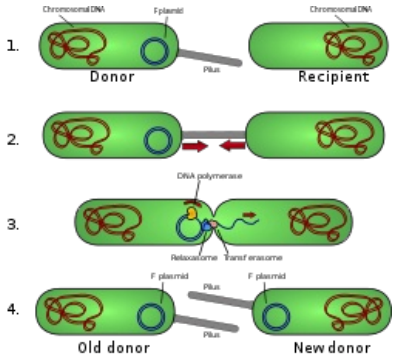
Parasexual processes in bacteria

Bakteria are organisms that multiply asexually. The exchange of genetic information progressess through parasexual processess during which the genetic information is transferred and recombined. There are 3 ways to pass this information - **conjugation, transformation and transduction.** Genes that are **selectively beneficial** for bacteria, such as virus resistence and antibiotic resistence, are transferred.

Conjugation

Conjugation is a gradual, controllable process. A **cytoplasmic connection** between the two bacteria is established in the form of a narrow tube and further part or all of the genome is transferred from the donor cell to the recipient cell.



Conjugation

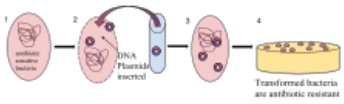
The presence of **sex chromatin (F-factor)** determines the ability to transfer part of its genetic equipment to another bacterium. F-factor forms a separate part of their genetic equipment (**F-plasmid**). We call such cells **F+** and they are always donors of genetic information. F factor genes determine the formation of fimbriae (**F-pili**) on the surface, which allows contact between bacteria. The F+ bacterium specifically binds to the surface of the recipient bacterium and transfers a single strand of its F-plasmid to it. The second strand is then synthesized in both bacteria.

The F plasmid replicates independently of the cell´s major chromosome. In the case of F-plasmid transfer, the **F-cell transforms into a F+ cell** and is also able to pass on its genetic information. The F plasmid may be part **of the main chromosome** (using insert sequences), in which case it is called **an episome**. The transferred part of the chromosome recombinates with the main chromosome of the recipient. Such cells show a high frequency of gene recombination and are reffered to as **Hfr bacteria.**

The described process is typical for **Gram-negative** bacteria. **Gram-positive** bacteria do not use pili but **adhesins**, which temporarily connect the cells to allow conjugation.

Transformation

Tranformation is the **transfer of genetic information between bacteria**. It is an active, enzyme-driven and energy-intensive process. **Reverse recombination** of the genetically active material takes place during the process. Isolated alleles or alleles released from donor cells are transferred to recipient cells (via DNA). For example, this process can bring in **virulence** genes.



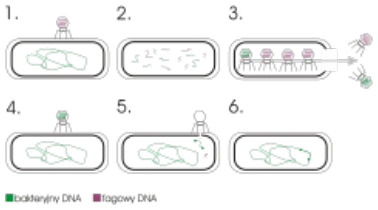
Transformation

This process can only take place in **genetically equipped species**, such as the genus Haemophilus, the genus Neisseria, Streptococcus pneumoniae, etc. In **gram-positive bacteria,** the presence of peptide called the **competence factor** is essential for transformation. For **gram-negative bacteria**, a competence factor isn´t needed, but transformation occurs only in very close-related bacteria.

The donor DNA **binds to the cell surface**, one strand is broken down, second one is transferred by the transporter into the cell. During the rapid division the mismatched bases can not be corrected. One chromosome is formed with the original equipment and the other one with the donor equipment. Half of the offspring are transformed and the other half are not.

Transduction

Transfer of part of the genetic information from one bacterium to another (recipient) via a bacteriophage. Transduction can take place only in the lysogenic cycle of virus reproduction.



Transduction

Generalized (general) transduction is an action in which a bacteriophage transfers **any part** of the donor genome (chromosome fragment or plasmid) into a recipient cell. It manifests itself as an inherited change in subsequent generations of bacteria if DNA has been incorporated into the chromosome of the recipient cell.

Specialized transduction is an action in which a mild bacteriofage transfers only a **certain part** of its chromosome from a donor to a recipient. The location of integration of the virus into the bacterial chromosome is precisely determined. Both the virus and the chromosome must contain the sequence att, by which they attach to each other, the circular chromosome of the bacterium and the virus are disconnected and the viral information is incorporated. The virus intergrated into into the bacterial chromosome is called a **prophage**. This process is **reversible** and the split-out virus can initiate the **lytic cycle** of the cell.

Abortive transduction is an action in which the transferred part of the donor genome does **not replicate** in the host.

Transduction is a natural element of modern genetic engineering, where a tempered phage corrects a host that inherited defect by introducing a normal gene into its genome.

Links

Related articles

- Prokaryote
- Viruses
- Gene Therapy
- Gene Manipulation

Sources

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Literature

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- KOHOUTOVÁ, Milada. *Lékařská biologie a genetika (II. díl).* 1. edition. Praha : Nakladatelství Karolinum, 2013. pp. 202. ISBN 978-80-246-1873-9.