

Reverse transcriptase

'Reverse transcriptase' (RT) is an RNA-dependent DNA polymerase. It catalyzes the transcription of single-stranded RNA (ssRNA) into single-stranded DNA (ssDNA) and belongs to a group of enzymes with polymerase activity. ^{[1][2]}

It was discovered in 1970 and was awarded the Nobel Prize. The discovery was quite revolutionary because it disrupted the current view of genetic information as a template for unidirectional transcription of DNA into mRNA and subsequent unidirectional translation into the final product, which is a protein. At least, the issue of genetic information was understood by the so-called "central dogma of molecular biology", which considered this one-way process (DNA → mRNA → protein) to be the only possible one. However, it turned out that transcription in the opposite direction from RNA → DNA is possible due to reverse transcriptase and is used not only by viruses, but even by some cells of the human body.

- The reverse transcription process is mainly used by 'retroviruses' (ssRNA-RT-viruses). A typical representative is, for example, HIV - *Human Immunodeficiency Virus*. After invading the host cell, these viruses use reverse transcriptase and their RNA to synthesize complementary DNA, which is incorporated into the genome of the invaded cell and, as a result, alters its metabolism, leading to later changes in the functions of the virus-damaged cell. In this context, research on reverse transcriptase inhibitors as possible antiviral treatment modalities is also being investigated. ^[3]
- Reverse transcriptase is also found in some undifferentiated human cells, which, during their lifetime, resynthesize the missing parts of the telomere during cell division. ^[4]

Use in molecular biological methods

- Reverse transcriptase is used in molecular biology to amplify material using the RT-PCR method, which is a variant of the classical PCR (Polymerase Chain Reaction). In classical PCR, it serves as a template for DNA amplification. RT-PCR uses RNA for amplification, which is converted to DNA by reverse transcriptase, and the sequel is analogous to classical PCR.
- In addition, reverse transcriptase is used, for example, in the production of insulin. In this case, the mRNA carrying the amino acid composition information of human insulin is inserted into the bacterial cell together with the reverse transcriptase. Within the bacterium, the mRNA is converted to DNA by reverse transcriptase and incorporated into the bacterial genome. The bacterial cell treated in this way begins to produce insulin. It is used in insulin therapy of diabetics and is better tolerated than previously used insulin from porcine pancreatic B-cells, which differs from human insulin in one amino acid.

Links

Used literature

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