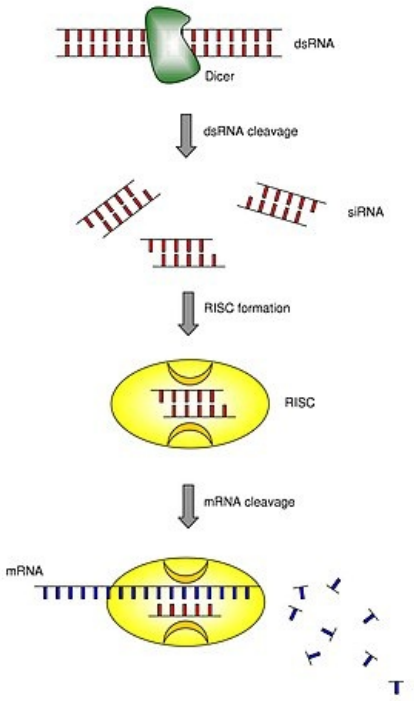
RNA interference

RNA interference is the process by which non-coding RNA molecules interfere (they pair up) with target regions of mRNA, resulting in **the prevention of gene expression** of those mRNAs. This process can also be referred to as RNAi. It is classified among the post-transcriptional mechanisms of gene expression. Most eukaryotic organisms are capable of RNA interference, a process first studied in the nematode *C. elegans*.

RNA interference pathways

The ability of RNAi is based on several events. First, the formation of small non-coding (interfering) RNA molecules must occur in the cell, which can be **siRNA** (short interfering RNA) or **microRNA** (miRNA). These molecules go through various modifications before reaching their final form. The siRNA or miRNA can then be **incorporated into ribonuclear particles**. Further modification of these non-coding RNAs must then take place in the ribonucleic particle. miRNA or siRNA is unraveled from its double-stranded form, one of the strands is **degraded** and **the other** remains **part of the ribonucleic particle**. Such a complex (ribonucleic particle with single-stranded siRNA or miRNA) is called RISC. **The RISC complex** is then ready to select an **mRNA target sequence** that is **complementary to the interfering RNA**. After the binding of the RISC complex to the target messenger RNA, the miRNA or siRNA interferes with the mRNA strand, which results in the **prevention of subsequent mRNA expression**. The interaction between an interfering non-coding RNA molecule and an mRNA can result in either **complete degradation** of the target mRNA (if the RISC matches perfectly with the mRNA sequence) or, if the RISC and the target mRNA sequence **do not match perfectly**, they will be permanently linked and thus prevent any mRNA translation.



Mechanism of RNA interference

Step by step interference

1. Entry of viral dsRNA / engineered dsRNA into the cell
2. dsRNA is cleaved by the specific endonuclease DICER (encoded by the DICER1 gene, from the RNase III family) [1] into small double-stranded molecules with a sequence of approx. 21 bp
3. The siRNA molecule is unfolded into two strands, one of which is degraded
4. RISC (RNA-induced silencing complex) complex = siRNA + Argonaut protein is formed
5. Using the complementarity of the siRNA chain, RISC binds to the mRNA molecule, which it cleaves thanks to its endonuclease activity and thus prevents translation

miRNAs are ssRNA molecules that are transcribed in the cell. Thanks to their hairpin-like structure, which resembles dsRNA, it can be recognized by the DICER and involved in RNA interference together with it.

Use

RNAi is mainly used in the destruction of dsRNA virus particles that attack the cell. Due to its ability to suppress translation, interference is used in genetic engineering.

Links

Related Articles

- RNA
- MiRNA

External links

RNAi Discovered (https://www.youtube.com/watch?v=H5udFjWDM3E) – YouTube video explanation

https://vydavatelstvi-old.vscht.cz/knihy/uid_es-002/ebook.html?p=rna-interference

https://en.wikipedia.org/wiki/RNA_interference?wprov=sfti1

Literature

1. SNUSTAD D and SIMMONS MICHAEL J. *Genetics* . Ed. 1. Brno: Masaryk University, 2009, xxi, 871 p.

2. ↑ SLABÝ ONDŘREJ and SVOBODA MAREK. *MicroRNAs in Oncology* . 1st ed. Prague: Galén, c2012, xvii, 324 p.

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