SYNTHESIS AND REPLICATION OF GENOMES OF VIRAL PROTEINS

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Annotation: This article provides information on the synthesis and replication of genomes of viral proteins

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In an infected cell, the viral genome encodes the synthesis of two protein groups:

1. non-structural proteins, serving for intracellular reproduction at different stages of the virus;

2. structural proteins that are part of a virion (genomic, related to viral genome, capsid, and supercapsid proteins).

TO unstructured white cell includes: 1) enzymes for RNA or DNA (RNA or DNA polymerase) synthesis that provide transcription and replication of the viral genome; 2) regulatory proteins; 3) precursors of viral proteins, characterized by their instability as a result of rapid cleavage of structural proteins; 4) enzymes that alter viral proteins, such as proteinases and protein kinases.

Protein synthesis is carried out in the cell in accordance with certain processes. reading mRNA in ribosomes. The transmission of genetic information regarding mRNA synthesis is not the same for different groups of viruses.

I. DNA-containing viruses carry out genetic information in the same way as the cellular genome in the scheme:

genomicVirus DNA- "transcriptionamRNA-" ethervirus protein.

In addition, DNA-containing viruses use cellular polymerase (viruses whose genomes are transcribed in the cell nucleus - adenoviruses, pavaviruses, herpes viruses) or their own RNA polymerases (viruses whose genomes are transcribed in the cytoplasm, such as poxviruses). .

II. Plus mRNA function with a genome performed by chain-chain RNA viruses (e.g., picornaviruses, flaviviruses, then gaviruses); it is recognized and translated by ribosomes. The synthesis of proteins in these viruses is carried out according to the following scheme without transcription:

translation of genomic RNA virus-> viral protein.

III. Minus single-stranded RNA-containing genome viruses (orthomyxoviruses, paramyxoviruses, rabdoviruses) and double-stranded (reoviruses) viruses serve as mRNA transcription matrices in the presence of nucleic acid-bound RNA polymerase. Their protein synthesis takes place according to the following scheme:

genomic RNA virus- ”transcription and- RNA- translation virus protein.

IV. Retroviruses (human immunodeficiency viruses, oncogenic retroviruses) have a specific way of transmitting genetic information. The genome of retroviruses consists of two identical RNA molecules, i.e. it is diploid. Retroviruses contain a specific enzyme specific to the virus - reverse transcriptase or reverse transcriptase, through which the reverse transcription process takes place, i.e., complementary single-stranded DNA (cDNA) is synthesized in the genomic RNA matrix. The complementary strand of DNA is copied to form double-stranded complementary DNA, which is integrated into the cell genome and transferred to mRNA using cellular DNA-binding RNA polymerase. Protein synthesis for these viruses is carried out according to the following scheme:

genomic RNA virus-> complementary DNA- "transcription mRNA

- "ether virus protein.

Replication of viral genomes, i.e., the synthesis of viral nucleic acids, results in the accumulation in the cell of copies of the original viral genomes used in the collection of virions. The method of genome replication depends on the type of nucleic acid of the virus, the presence of virus-specific or cellular polymerases, as well as the ability of the viruses to stimulate the formation of polymerase in the cell.

The replication mechanism is different for viruses that have the following viruses:

1) double-stranded DNA; 2) single-stranded DNA; 3) excess single-stranded RNA;

4) minus single-stranded RNA; 5) double-stranded RNA; 6) RNAs (retroviruses) of the same plus chain.

1. Two-chain LNK viruses. Replication of double-stranded viral DNA occurs by the usual semi-conservative mechanism: once the DNA strands are separated, new strands fill them. Each newly synthesized DNA molecule consists of a single parent and a single newly synthesized chain. This series of viruses includes a large group of viruses that contain double-stranded DNA in a linear form (e.g., herpes viruses, adenoviruses, and poxviruses) or in a round form, such as papillomaviruses. In all viruses, except poxviruses, transcription of the viral genome occurs in the nucleus.

The unique replication mechanism is specific to hepadnaviruses (hepatitis B virus). The genome of hepatadnaviruses is represented by double-stranded round DNA, one strand of which is shorter than the other (incomplete plus strand). Initially, it is being completed (Figure 3.7). Complete double-stranded DNA is then transcribed by cellular DNA-binding RNA polymerase to form small mRNA molecules and complete single-stranded excess RNA. The second is called pregenomic RNA; it is a template for replication of the viral genome. Synthesized mRNAs are involved in the translation of proteins, including viral RNA-linked DNA polymerase (reverse transcriptase). The pregenomic RNA that is transferred to the cytoplasm using this enzyme is transcribed to the minus chain of the reverse DNA, which in turn serves as a template for the synthesis of the DNA plus chain. This process ends with the formation of double-stranded DNA, which contains an incomplete excess DNA strand.

Single-stranded DNA viruses. Parvoviruses are the only representatives of single-stranded DNA viruses. Parvoviruses use cellular DNA polymerases to create a double-stranded viral genome, the latter being called a replicative form. However, the minus DNA strand is complemented in the original virus DNA (plus-strand), which serves as a matrix to synthesize the DNA plus strand of the new virion. In parallel, mRNA is synthesized and viral peptides are translated.

Plus single-stranded RNA viruses. These viruses include a large group of viruses - picornaviruses, flaviviruses, togaviruses (Figure 3.8), in which the genomic RNA plus chain acts as an mRNA. For example, once poliovirus RNA enters a cell, it binds to ribosomes that perform the function of mRNA, and on its basis a large polypeptide is synthesized, which is broken down into: RNA-dependent RNA polymerase, viral proteases, and capsid proteins. Genomic RNA plus chain polymerase synthesizes RNA minus chain; a temporary double RNA called the intermediate replicative link is formed. This replicative interval consists of a complete RNA plus chain and many partially completed minus strands. When all the minus chains are formed, they are used as a template to synthesize new RNA plus chains. This mechanism is used both to replicate the genomic RNA of the virus and to synthesize large amounts of viral proteins.

Minus single-stranded RNA viruses. Minus single-stranded RNA viruses (rabdoviruses, paramyxoviruses, orthomyxoviruses) contain RNA-dependent RNA polymerase. The genomic minus chain of RNA entering the cell is converted into incomplete and complete plus chains of RNA under the influence of viral RNA-dependent RNA polymerase. Incomplete copies play the role of mRNA to synthesize viral proteins. Full copies are a template (intermediate stage) for synthesizing the minus chains of the genomic RNA of the offspring.

Two-stranded RNA viruses. The replication mechanism of these viruses (reoviruses and rotaviruses) is similar to the replication of minus single-stranded RNA viruses. The difference is that the plus chains formed during transcription not only perform the function of mRNA, but also participate in replication: they are a template for synthesizing RNA minus chains. The second, together with RNA plus chains, forms the genomic double-stranded RNA of virions. Replication of viral nucleic acids of these viruses occurs in the cytoplasm of cells.

6. Retroviruses (plus-chain diploid RNA viruses). The reverse transcriptase of retroviruses (in the RNA virus template) synthesizes the minus strand of DNA, from which the plus strand of DNA is copied and forms a double strand of DNA enclosed in a ring (Figure 3.10). In addition, the double strand of DNA combines

with the cell chromosome to form a provirus. Numerous virion RNAs are formed by the transcription of one of the combined DNA strands in the presence of cellular DNA-binding RNA polymerase.

Formation of viruses. Virions are formed by spontaneous assembly: the components of the virion are transferred to the sites of assembly of the virus - the cell nucleus or areas of the cytoplasm. The bonding of virion components is caused by the presence of hydrophobic, ionic, hydrogen bonds and steric compatibility.

References

1. King, A. M., Lefkovits, E., Adams, M. J. and Carstens, E. B. (Eds.). (2011). Virus Taxonomy: Ninth Report of the International Committee on Virus Taxonomy (Vol. 9). Elsevier.

2. Marcdante, K., & Kliegman, R. M. (2016). Nelson Essentials of Pediatrics-E-book: The First South Asian Edition. Elsevier Health Sciences.

3. Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2017). Medical microbiology. Elsevier Health Sciences.

4. Oxford, J. S., Collier, L. H., & Kellam, P. (2016). Human virology. Oxford University Press.