Study of viruses material RNA or DNA

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Abstract:

A virus is a submicroscopic infectious agent that replicates only inside the living cells of an organism. Most viruses have either RNA or DNA as their genetic material. The nucleic acid may be single- or double-stranded. The entire infectious virus particle, called a virion, consists of the nucleic acid and an outer shell of protein. The simplest viruses contain only enough RNA or DNA to encode four proteins. A virus is a small parasite that cannot reproduce by itself. Once it infects a susceptible cell, however, a virus can direct the cell machinery to produce more viruses. Most viruses have either RNA or DNA as their genetic material. The nucleic acid may be single- or double-stranded. A virus is a submicroscopic infectious agent that replicates only inside the living cells of an organism. Too we conducted that the genome replication of most DNA viruses takes place in the cell's nucleus. If the cell has the appropriate receptor on its surface, these viruses enter the cell either by direct fusion with the cell membrane

Keywords: Viruses, structure, genome, DNA. RNA

Introduction

Replication of RNA viruses usually takes place in the cytoplasm. RNA viruses can be placed into four different groups depending on their modes of replication. The polarity (whether or not it can be used directly by ribosomes to make proteins) of single-stranded RNA viruses largely determines the replicative mechanism; the other major criterion is whether the genetic material is single-stranded or double-stranded. All RNA viruses use their own RNA replicase enzymes to create copies of their genomes. Transmission of viruses can be vertical, which means from mother to child, or horizontal, which means from person to person. Examples of vertical transmission include hepatitis B virus and HIV, where the baby is born already infected with the virus. Another, more rare, example is the varicella zoster virus, which, although causing relatively mild infections in children and adults, can be fatal to the foetus and newborn baby. Horizontal transmission can occur when body fluids are exchanged during sexual activity, by exchange of saliva or when contaminated food or water is ingested. It can also occur when aerosols containing viruses are inhaled or by insect vectors such as when infected mosquitoes penetrate the skin of a host. Most types of viruses are restricted to just one or two of these mechanisms and they are referred to as "respiratory viruses" or "enteric viruses" and so forth.

Epidemiology is used to break the chain of infection in populations during outbreaks of viral diseases. Control measures are used that are based on knowledge of how the virus is transmitted. It is important to find the source, or sources, of the outbreak and to identify the virus. Once the virus has been identified, the chain of transmission can sometimes be broken by vaccines. When vaccines are not available, sanitation and disinfection can be effective. Often, infected people are isolated from the rest of the community, and those that have been exposed to the virus are placed in quarantine. To control the outbreak of foot-and-mouth disease in cattle in Britain in 2001, thousands of cattle were slaughtered. Most viral infections of humans and other animals have incubation periods during which the infection causes no signs or symptoms. Incubation periods for viral diseases range from a few days to weeks, but are known for most infections. Somewhat overlapping, but mainly following the incubation period, there is a period of communicability—a time when an infected individual or animal is contagious and can infect another person or animal. If outbreaks spread worldwide, they are called pandemics.

In many cases, DNA viruses utilize cellular enzymes for synthesis of their DNA genomes and mRNAs; all viruses utilize normal cellular ribosomes, tRNAs, and translation factors for synthesis of their proteins. Most viruses comman-deer the cellular machinery for macromolecular synthesis during the late phase of infection, directing it to synthesize large amounts of a small number of viral mRNAs and proteins instead of the thousands of normal cellular macromolecules.

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The nucleic acid of a virion is enclosed within a protein coat, or capsid, composed of multiple copies of one protein or a few different proteins, each of which is encoded by a single viral gene. Because of this structure, a virus is able to encode all the information for making a relatively large capsid in a small number of genes. This efficient use of genetic information is important, since only a limited amount of RNA or DNA, and therefore a limited number of genes, can fit into a virion capsid. A capsid plus the enclosed nucleic acid is called a nucleocapsid. Nature has found two basic ways of arranging the multiple capsid protein subunits and the viral genome into a nucleocapsid. The simpler structure is a protein helix with the RNA or DNA protected within. Tobacco mosaic virus (TMV) is a classic example of the helical nucleocapsid. In TMV the protein subunits form broken disklike structures, like lock washers, which form the helical shell of a long rodlike virus when stacked together (Figure 1).

Figure 1 : Show plant infected by mild mottle virus

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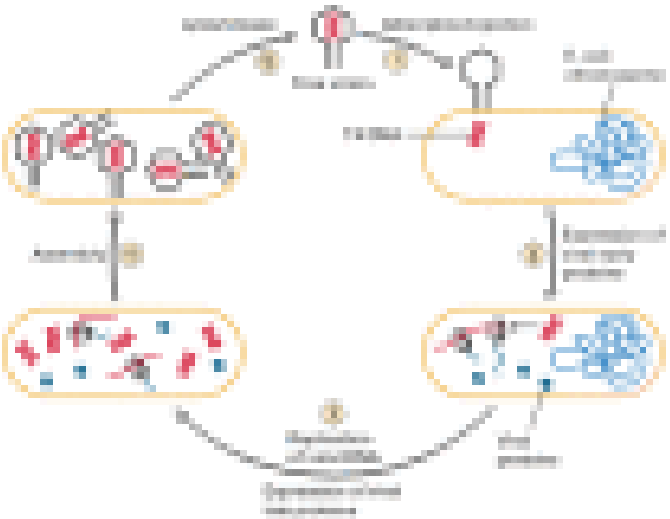

Figure 2: Viral Growth Cycles Are Classified as Lytic

There are Four Types of Bacterial Viruses Are Widely Used in Biochemical and Genetic

The T phages of E. coli are large lytic phages that contain a single molecule of double-stranded DNA. This molecule is about 2×10^5 base pairs long in T2, T4, and T6 viruses and about 4×10^4 base pairs long in T1, T3, T5, and T7 viruses. T-phage virions consist of a helical protein “tail” attached to an icosahedral “head” filled with the viral DNA. After the tip of a T-phage tail adsorbs to receptors on the surface of an E. coli cell, the DNA in the head enters the cell through the tail (see Figure 6-16). The phage DNA then directs a program of events that produces approximately 100 new phage particles in about 20 minutes, at which time the infected cell lyses and releases the new phages. The initial discovery of the role of messenger RNA in protein synthesis was based on studies of E. coli cells infected with bacteriophage T2. By 20 minutes after infection, infected cells synthesize T2 proteins only.

Where are found viruses

Viruses are found wherever there is life and have probably existed since living cells first evolved.[46] The origin of viruses is unclear because they do not form fossils, so molecular techniques are used to investigate how they arose.[47] In addition, viral genetic material occasionally integrates into the germline of the host organisms, by which they can be passed on vertically to the offspring of the host for many generations. This provides an invaluable source of information for paleovirologists to trace back ancient viruses that have existed up to millions of years ago. There are three main hypotheses that aim to explain the origins of viruses.

Regressive hypothesis and Cellular origin hypothesis

Viruses may have once been small cells that parasitised larger cells. Over time, genes not required by their parasitism were lost. The bacteria rickettsia and chlamydia are living cells that, like viruses, can reproduce only inside host cells. They lend support to this hypothesis, as their dependence on parasitism is likely to have caused the loss of genes that enabled them to survive outside a cell. This is also called the 'degeneracy hypothesis' or 'reduction hypothesis'.

Some viruses may have evolved from bits of DNA or RNA that "escaped" from the genes of a larger organism. The escaped DNA could have come from plasmids (pieces of naked DNA that can move between cells) or transposons (molecules of DNA that replicate and move around to different positions within the genes of the cell).[53] Once called "jumping genes", transposons are examples of mobile genetic elements and could be the origin of some viruses. They were discovered in maize by Barbara McClintock in 1950 This is sometimes called the 'vagrancy hypothesis' or the 'escape hypothesis'

This is also called the 'virus-first hypothesis'[52] and proposes that viruses may have evolved from complex molecules of protein and nucleic acid at the same time that cells first appeared on Earth and would have been dependent on cellular life for billions of years. Viroids are molecules of RNA that are not classified as viruses because they lack a protein coat. They have characteristics that are common to several viruses and are often called subviral agents. Viroids are important pathogens of plants.

They do not code for proteins but interact with the host cell and use the host machinery for their replication

The hepatitis delta virus of humans has an RNA genome similar to viroids but has a protein coat derived from hepatitis B virus and cannot produce one of its own. It is, therefore, a defective virus. Although hepatitis delta virus genome may replicate independently once inside a host cell, it requires the help of hepatitis B virus to provide a protein coat so that it can be transmitted to new cells.[59] In similar manner, the sputnik virophage is dependent on mimivirus, which infects the protozoan *Acanthamoeba castellanii*. These viruses, which are dependent on the presence of other virus species in the host cell, are called 'satellites' and may represent evolutionary intermediates of viroids and viruses.

The evidence for an ancestral world of RNA cells and computer analysis of viral and host DNA sequences are giving a better understanding of the evolutionary relationships between different viruses and may help identify the ancestors of modern viruses. To date, such analyses have not proved which of these hypotheses is correct. It seems unlikely that all currently known viruses have a common ancestor, and viruses have probably arisen numerous times in the past by one or more mechanisms.

Conclusion

- Viruses are intracellular parasites that replicate only after infecting specific host cells. Viral infection begins when proteins on the surface of a virion bind to specific receptor proteins on the surface of host cells. The specificity of this interaction determines the host range of a virus.
- Aside from being the causative agents of many diseases, viruses are important tools in cell biology research, particularly in studies on macromolecular synthesis.
- Viruses can be counted and cloned by the plaque assay .All the virions in a single plaque compose a clone derived from the single parental virion that infected the first cell at the center of the plaque.
- Individual viral particles (virions) generally contain either an RNA or a DNA genome, surrounded by multiple copies of one or a small number of coat proteins, forming the nucleocapsid. The nucleocapsid of many animal viruses is surrounded by a phospholipid bilayer, or envelope.

- During lytic replication, host-cell ribosomes and enzymes are used to express viral proteins, which then replicate the viral genome and package it into viral coats.
- Some bacterial viruses (bacteriophages) may undergo lysogeny following infection of host cells. In this case, the viral genome is integrated into host-cell chromosomes, forming a prophage that is replicated along with the host genome.
- Recombinant viruses can be used as vectors to carry (transduce) selected genes into cells. In this approach, viral genes required for the lytic cycle are replaced by other genes.

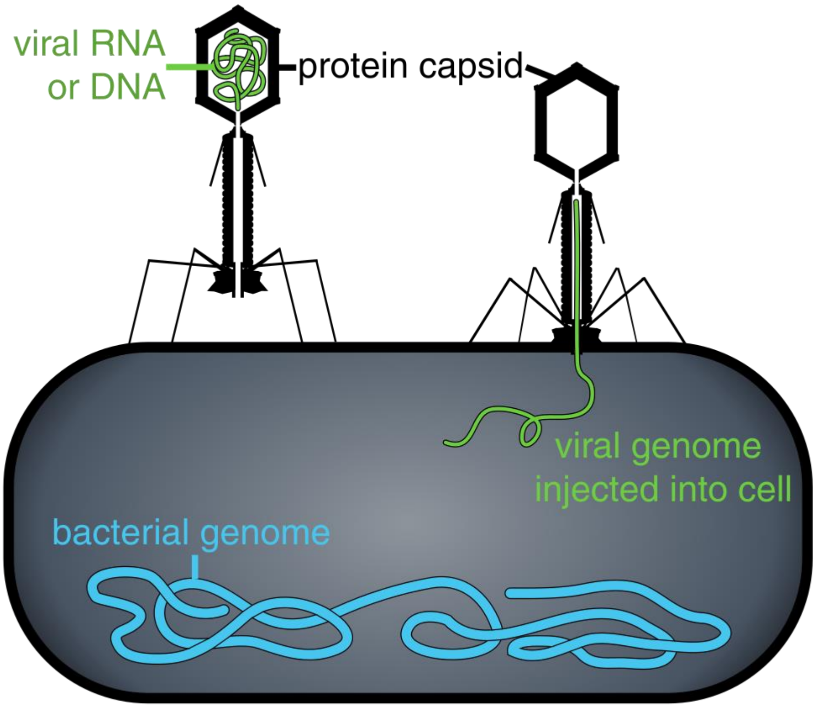

Figure 3: Some bacteriophages inject their genomes into bacterial cells

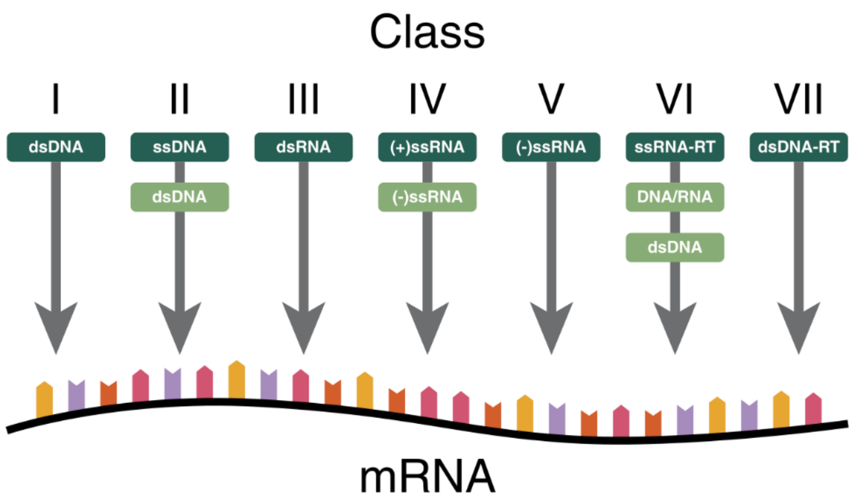

Figure 4: The Baltimore Classification of viruses is based on the method of viral mRNA synthesis

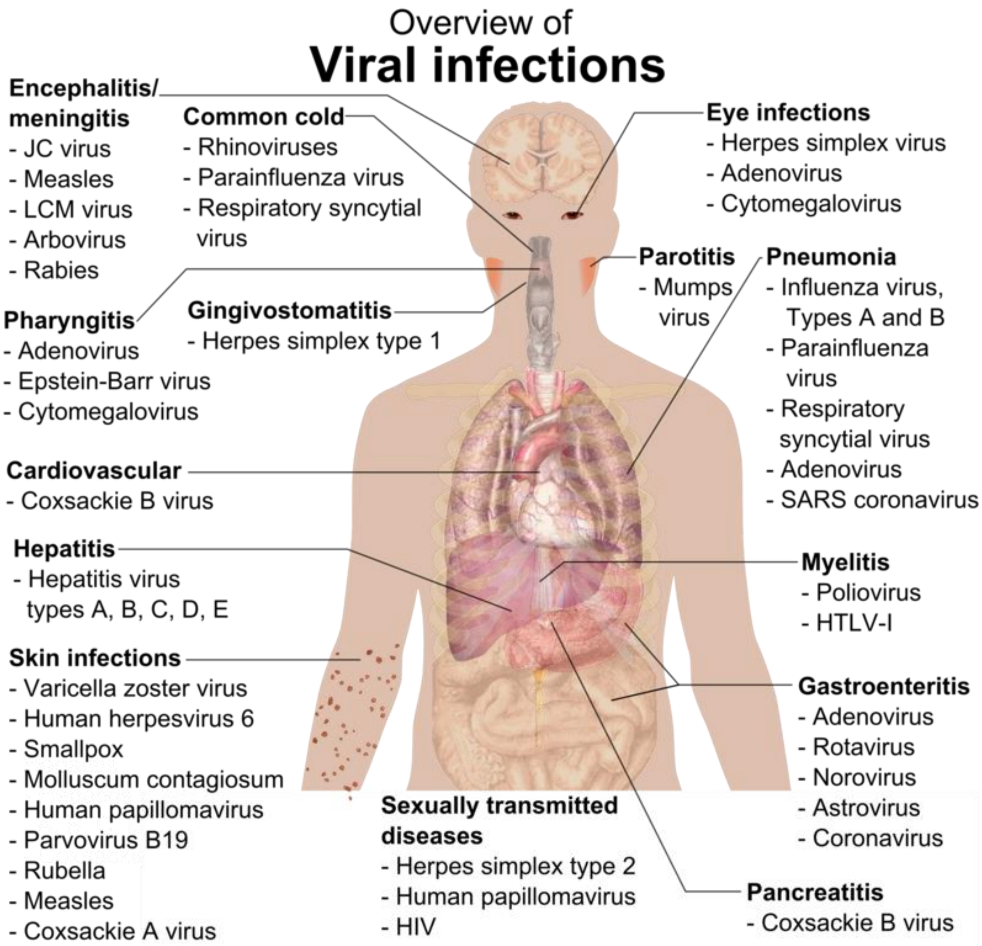

Figure 5: Overview of the main types of viral infection and the most notable species involved

In this paper we studied that Plant viruses (Phytophages) principally attack plants and majority of them possess single stranded RNA. Plant viruses or reoviridae contain of RNA as genetic material. ... Animal viruses (Zoophages) are those viruses that principally attack animals and possess double stranded DNA.

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