Replication of DNA and RNA virus

Replication of Viruses

Populations of viruses do not grow through cell division because they are not cells. Instead, they use the machinery and metabolism of a host cell to produce new copies of themselves. After infecting a host cell, a virion uses the cell's ribosomes, enzymes, ATP, and other components to replicate. Viruses vary in how they do this. For example:

- Some RNA viruses are translated directly into viral proteins in ribosomes of the host cell. The host ribosomes treat the viral RNA as though it were the host's own mRNA.
- Some DNA viruses are first transcribed in the host cell into viral mRNA. Then the viral mRNA is translated by host cell ribosomes into viral proteins.

In either case, the newly made viral proteins assemble to form new virions. The virions may then direct the production of an enzyme that breaks down the host cell wall. This allows the virions to burst out of the cell. The host cell is destroyed in the process. The newly released virus particles are free to infect other cells of the host.

Replication of RNA Viruses

An **RNA virus** is a virus that has RNA as its genetic material. Their nucleic acid is usually single-stranded RNA, but may be double-stranded

RNA. Important human pathogenic RNA viruses include the Severe Acute Respiratory Syndrome (SARS) virus, Influenza virus, and Hepatitis C virus. Animal RNA viruses can be placed into different groups depending on their type of replication.

- Some RNA viruses have their genome used directly as if it were mRNA. The viral RNA is translated directly into new viral proteins after infection by the virus.
- Some RNA viruses carry enzymes which allow their RNA genome to act as a template for the host cell to a form viral mRNA.
- **Retroviruses** use DNA intermediates to replicate. **Reverse transcriptase**, a viral enzyme that comes from the virus itself, converts the viral RNA into a complementary strand of DNA, which is copied to produce a double stranded molecule of viral DNA. This viral DNA is then transcribed and translated by the host machinery, directing the formation of new virions. Normal transcription involves the synthesis of RNA from DNA; hence, reverse transcription is the *reverse* of this process. This is an exception to the central dogma of molecular biology.

Replication of DNA Viruses

A **DNA virus** is a virus that has DNA as its genetic material and replicates using a DNA-dependent DNA polymerase. The nucleic acid is usually double-stranded DNA but may also be single-stranded DNA. The DNA of DNA viruses is transcribed into mRNA by the host cell. The viral mRNA

is then translated into viral proteins. These viral proteins then assemble to form new viral particles.

Reverse-Transcribing Viruses

A **reverse-transcribing virus** is any virus which replicates using reverse transcription, the formation of DNA from an RNA template. Some reverse-transcribing viruses have genomes made of single-stranded RNA and use a DNA intermediate to replicate. Others in this group have genomes that have double-stranded DNA and use an RNA intermediate during genome replication. The retroviruses, as mentioned above, are included in this group, of which HIV is a member. Some double-stranded DNA viruses replicate using reverse transcriptase. The hepatitis B virus is one of these viruses.

Bacteriophages

Bacteriophages are viruses that infect bacteria. They bind to surface receptor molecules of the bacterial cell and then their genome enters the cell. The protein coat does not enter the bacteria. Within a short amount of time, in some cases, just minutes, bacterial polymerase starts translating viral mRNA into protein. These proteins go on to become either new virions within the cell, helper proteins which help assembly of new virions, or proteins involved in cell lysis. Viral enzymes aid in the breakdown of the cell membrane. With some phages, just over twenty minutes after the phage infects the bacterium, over three hundred phages can be assembled and released from the host.