

Chapter 14 Viruses, Prions, Viroids: Infectious Agents of Animals and Plants

Summary Outline

- 14.1 Structure and Classification of Animal Viruses
- A. **Structure** of animal viruses
 1. Animal viruses consist of **nucleic acid** surrounded by a **protein coat**, the **capsid**.
 2. Some have an **envelope**, which is a **lipid bilayer** similar to the plasma membrane of the host.
 3. **Segmented viruses** contain more than one RNA molecule.
 - B. **Classification** of animal viruses—Criteria
 1. **Genome structure**
 2. **Particle structure**
 3. **Presence or absence of a viral envelope**
 - C. **Groupings based on routes of transmission**
 1. **Enteric viruses**
 2. **Respiratory viruses**
 3. **Zoonoses** (transferred from animals to other animals)
 4. **Sexually transmitted diseases**
- 14.2 **Methods used to study viruses**
- A. **Cultivation** of host cells in **living animals**; others can be grown in **tissue culture**.
 - B. **Quantitation** by **plaque assay**, **virions counted** with the electron microscope, **quantal assays** or **hemagglutination**.
- 14.3 **Interactions of animal viruses with their hosts**
- A. Most viruses do not kill their host.
 - B. **Acute infections** are **self-limited** in which the virus remains localized and diseases are of short duration and lead to lasting immunity.
 - C. The **replication cycle** is similar to that of phage T4.
 - D. The steps in the infection process include:
 1. **Attachment** to specific receptors
 2. **Entry** of the virus or **penetration** of the entire virion
 3. **Targeting** to the site of viral replication
 4. **Uncoating** – removal of the capsid
 5. **Replication** of nucleic acids and proteins
 - a. **Transcription** of the viral genome into mRNA
 - b. **Replication of virus DNA and proteins**
 6. **Maturation** – assembly of the virus
 7. **Release** of the virion so that it infects other cells
 8. **Shedding** – leaving the host
 9. **Transmission**
 - a. **Persistent infections** are infections in which the virions are continually present in the body and are released from cells by budding. They can be:
 1. **Late complications** following an acute infection
 2. **Latent infections**
 3. **Chronic infections**

4. **Slow infections**

- F. **Complex infections:** Infections with the characteristics of more than one category. Example: **HIV infection**, which has characteristics of a chronic, latent and slow viral infection.

14.4 **Virus-induced tumors:** General aspects

- A. One class of host cell regulatory genes that are commonly involved in tumor formation is **proto-oncogenes**
- B. Mutations in either of this gene class predisposes the host to tumor formation.
- C. Proto-oncogenes are transcriptional activators

14.5 **Viruses and animal tumors**

- A. **Retroviruses** are the most important tumor viruses in animals.
- B. **Oncogenes**, which are mutants from the host's cell proto-oncogenes, can modify the properties of cells growing in tissue culture.
- C. **Retroviruses** transform cells by inserting **oncogenes** into the genome of the host cell and interfere with the normal **intracellular control functions** of the cell's **proto-oncogenes**.

14.6. **Viruses and human tumors**

- A. **Human tumors** caused by viruses are primarily caused by **double-stranded DNA tumor viruses**.
- B. Tumor formation is promoted by the interaction of **products** of the **oncogenes** with **tumor-suppressor proteins**.
- C. **Retroviruses** cause a rare leukemia.

14.7 **Viral host range**

- A. Most viruses can infect only **certain cells** within a **single species**.
- B. **Viruses** causing **zoonoses** can multiply in widely divergent species.
- C. **Viruses** can **modify their host range** if two viruses with different host ranges can infect the same cell.
- D. Protein coats may be exchanged in phenotypic mixing.
- E. Genomes may be exchange in segmented viruses.

14.8 **Plant viruses**

- A. Many **plant diseases** are caused by viruses.
- B. **Virions enter through wound sites**.
- C. **Spread of plant viruses** is largely by humans, by planting seeds in contaminated soils, through transfer from infected plants by grafting and through the parasitic plant, dodder, which can establish connections between an infected and uninfected plant.
- D. **Plant viruses** may be transmitted by **insects**.

14.9 **Virus-like agents**

- A. **Prions**, which consist of **protein and no nucleic acid**, have been linked to a number of **fatal neurodegenerative diseases** called transmissible spongiform encephalopathies
- B. **Viriods**, which are plant pathogens that consist of **circular, single-stranded RNA molecules**, are about one-tenth the size of the smallest infectious viral RNA known.