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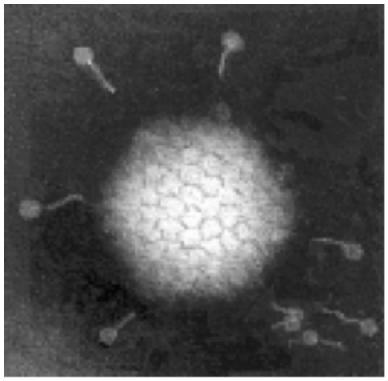
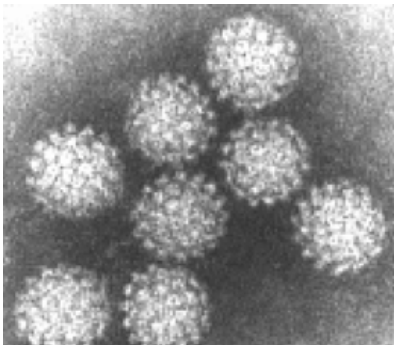
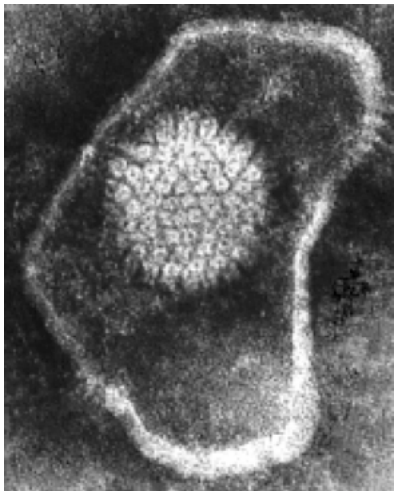
This section begins by reviewing the basics of the DNA viruses and introduces the Baltimore classification system.

8 DNA Virus Families

	**Virus:** Adenovirus **Family:** Adenoviridae	**Characteristics**
	**Virus:** Papillomavirus **Family:** Papillomaviridae	**Characteristics**
	**Virus:** Herpesvirus **Family:** Herpesviridae	**Characteristics**

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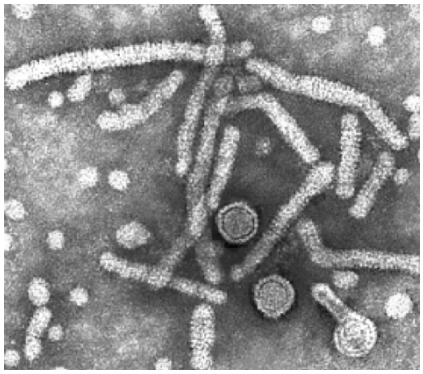
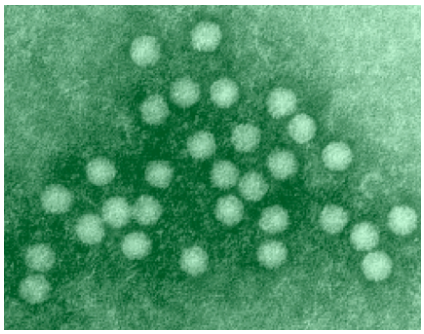
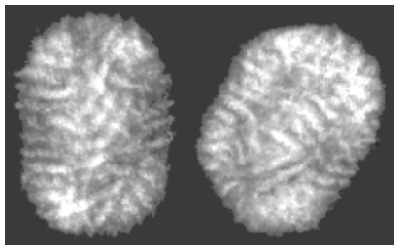
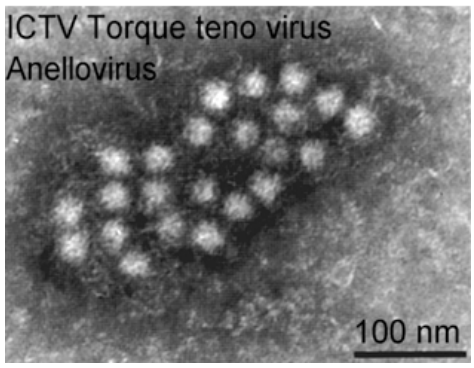
DNA Viruses Continued

	**Virus:** Hepatitis B Virus **Family:** Hepadnaviridae	**Characteristics**
	**Virus:** Parvovirus **Family:** Parvoviridae	**Characteristics**
	**Virus:** Molluscum contagiosum **Family:** Poxviridae	**Characteristics**
	**Virus:** Torque teno virus **Family:** Anelloviridae	**Characteristics**

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DNA Virus Families Continued

<table>
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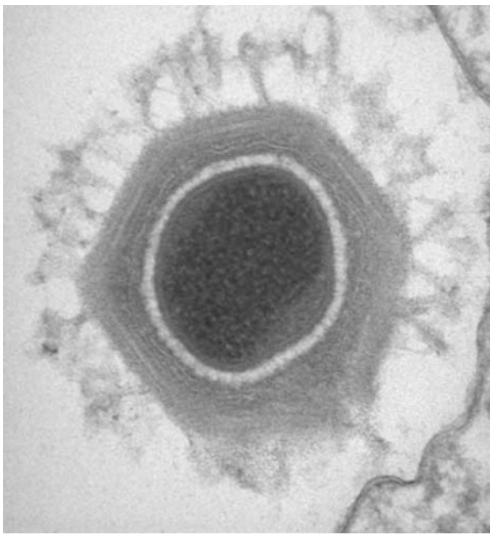
<td rowspan="3">  </td>
<td colspan="2">Virus: Mimivirus
Family: Mimiviridae</td>
<td rowspan="3">Characteristics</td>
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<tr>
<td>Virus</td>
<td>Disease</td>
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<tr>
<td>Virus</td>
<td>Disease</td>
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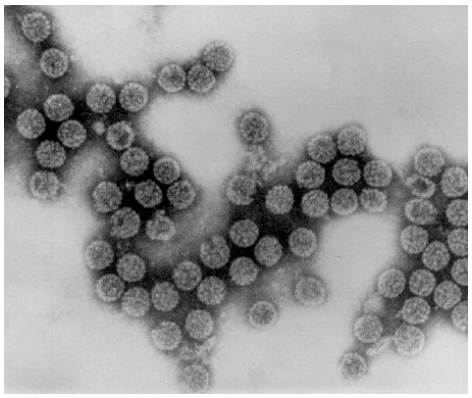
<td rowspan="3">  </td>
<td colspan="2">Virus:
Family: Polyomaviridae</td>
<td rowspan="3">Characteristics</td>
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<tr>
<td>Virus</td>
<td>Disease</td>
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<td>Disease</td>
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</table>

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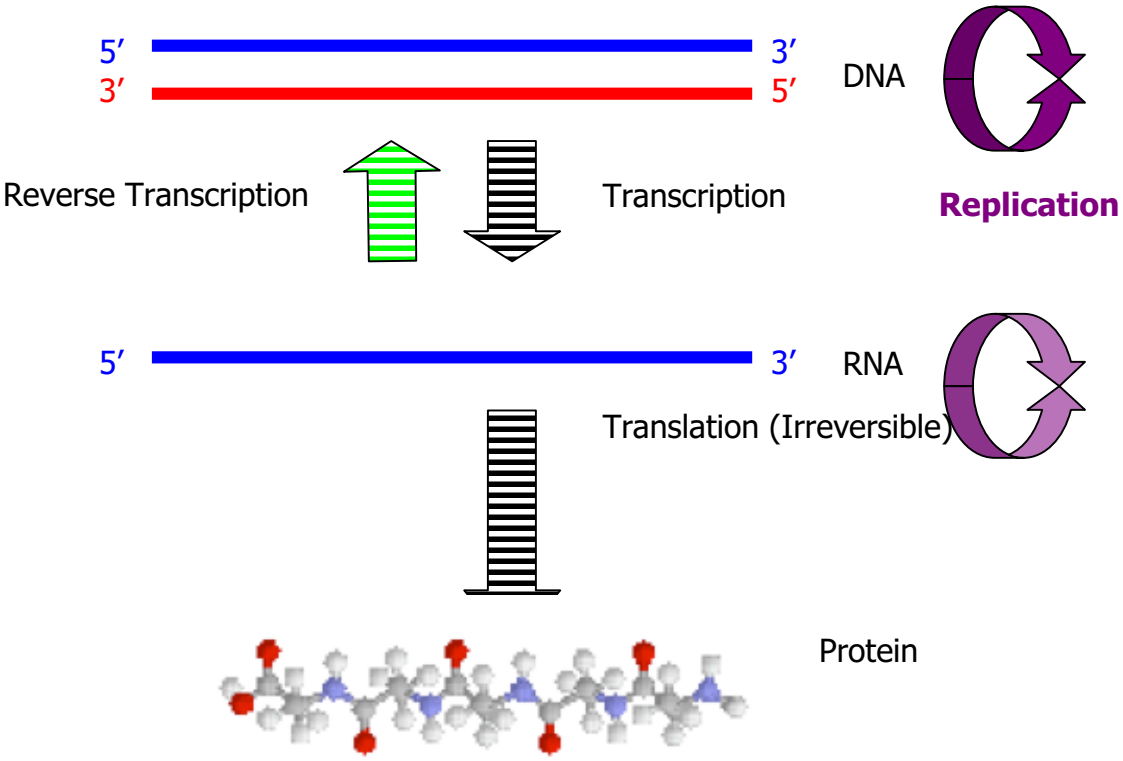
Benjamin Lewin, Genes VII. Chapter 1, Page 32.
Figure 1.34: The central dogma states that information in nucleic acid can be perpetuated or transferred, but the transfer of information into protein is irreversible.



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Viral Classification

Historically, viruses were classified together based on disease or symptoms. Currently, we use a non-systematic, polythetic and hierarchical structure, as outlined below.

1) Hierarchical based on the Linnaean Classification System

2) Baltimore Classification System – groups viruses with related lifestyles together
    a. Class I – dsDNA – DNA dependent DNA Polymerase, DNA Pol III, Viral Pol
    b. Class II – ssDNA
    c. Class III – dsRNA
    d. Class IV – (+)ssRNA – RNA dependent RNA Polymerase, RNA Replicase
    e. Class V – (-)ssRNA – RNA dependent RNA Polymerase, RNA Replicase
    f. Class VI – (+)ssRNA-RT
    g. Class VII – dsDNA-RT

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Baltimore Classification System.

1) Class I: dsDNA viruses (e.g., Papilloma, Herpes, Pox, Adeno, Mimi, Polyoma)

Papa has Pox and Mimi's Polygraph.

a. These viruses must typically enter the host nucleus to replicate.
b. These viruses typically require host DNA dependent DNA polymerase to replicate, so the host cell must be in S phase for productive infection.
c. The only well studied Class I virus family that replicates outside the nucleus is the Poxvirus, which replicates in the cytoplasm.

2) Class II: ssDNA Viruses (e.g., Parvoviridae, Anelloviridae)

Small (parvo) viruses replicate in rings (Anello).

a. Anello may replicate within the nucleus using a rolling circle mechanism.
b. Parvo replicates using hairpin structures as primer.
c. Newly synthesized ssDNA can either:
    i. Be converted to dsDNA, which serves as a template for transcription/replication, OR
    ii. Be encapsidated by capsid proteins, forming virions.

3) Class III: dsRNA viruses (e.g., Reoviridae)

Reoviridae has dsRNA.

a. As with most RNA viruses, this class replicates in the cytoplasm
b. Requires an RNA dependent RNA polymerase.
c. Reovirus is segmented.

4) Class IV: (+)ssRNA viruses (e.g, Flavi, Hepe, Toga, Corona, Picorna, Calici, Astro)

FLAVa-FLAV is having a HEPE-ening TOGA party with CORONA in PICO, CALI-ASTRO!

a. Viral genome can be read by ribosomes and immediately translated.
b. These can be divided into two groups, both of which reproduce in the cytoplasm.
    i. **Viruses with polycistronic mRNA:** The genome RNA = mRNA that is translated into a polyprotein, which is subsequently cleaved to form the mature proteins.
    ii. **Viruses with complex transcription**, for which subgenomic mRNAs, ribosomal frameshifting, and proteolytic processing of polyproteins may be used.

5) Class V: (-)ssRNA viruses (e.g., Arena, Bunya, Paramyxo, Orthomyxo, Filo, Rhabdo).

Always Bring Polymerase Or Fail Replication.

a. Sequences defined as negative sense cannot be directly read by host ribosomes.
b. These can be divided into two groups:
    i. **Viruses containing non-segmented genomes,** for which the first step in replication is transcription from (-)ssRNA by the viral RNA-dependent RNA polymerase to yield monocistronic mRNAs that code for the various viral proteins. A (+) sense genome copy is then produced that serves as a template for the production of the (-)ssRNA genome. Replication occurs in the cytoplasm.
    ii. **Viruses with segmented genomes,** for which replication occurs in the nucleus and for which the viral RNA dependent RNA polymerase produces monocistronic mRNAs from each genome segment. The largest difference between the two is the location of replication.

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6) ClassVI: (+)ssRNA-RT viruses with a DNA intermediate (e.g, Retro)
    a. One defining feature is the use of reverse transcriptase to convert to the (+)ssRNA into DNA.
    b. Instead of using the RNA for templates of proteins, they use DNA to create the templates, which is spliced into the host genome using an integrase.
    c. Replication can then commence with the help of the host cell's polymerases.

7) Class VII: dsDNA-RT viruses (e.g., Hepadnaviridae)
    a. This small group of virses, exemplified by the Hepatitis B virus, have ds, gapped genome that is subsequently filled in to form a covalently closed circle (cccDNA).
    b. The cccDNA serves as a template for the production of viral mRNAs and a subgenomic RNA.
    c. The pregenome RNA serves as template for the viral reverse transcriptase and for the production of the viral genome.