Practical Biology Lecture - 7

Kidney Dialysis Techniques Department

Prof . Dr. Younis A. Alkhafaj

Viruses, Types and Diseases

Learning Objectives

1- Define a virus and state its basic characteristics that distinguish it from living organisms.

2- Explain the simple structure of a virus (Genetic Material + Protein Coat).

3- Classify viruses practically based on genetic material (DNA vs. RNA).

4- Associate major viral groups with examples of common diseases they cause.

5- Understand the basic principle of viral infection (replication inside a living cell).

What is a Virus?

(A Riddle Between Life and Non-Life)

Definition: A very small infectious agent that can only replicate inside the living cells of an organism.

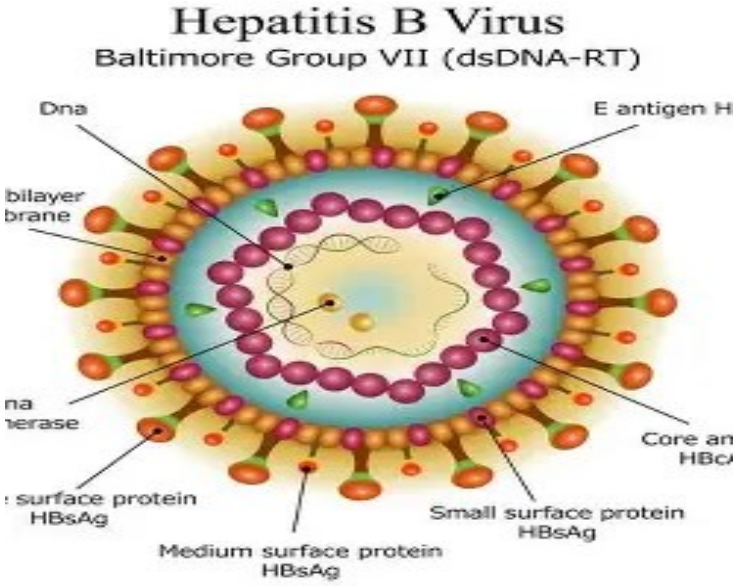
- **Not a cell: Contains no organelles (no nucleus, no ribosomes, no cytoplasm).**
- **Size: 10 to 100 times smaller than bacteria (visible only with an electron microscope).**
- **Basic Simple Structure:**

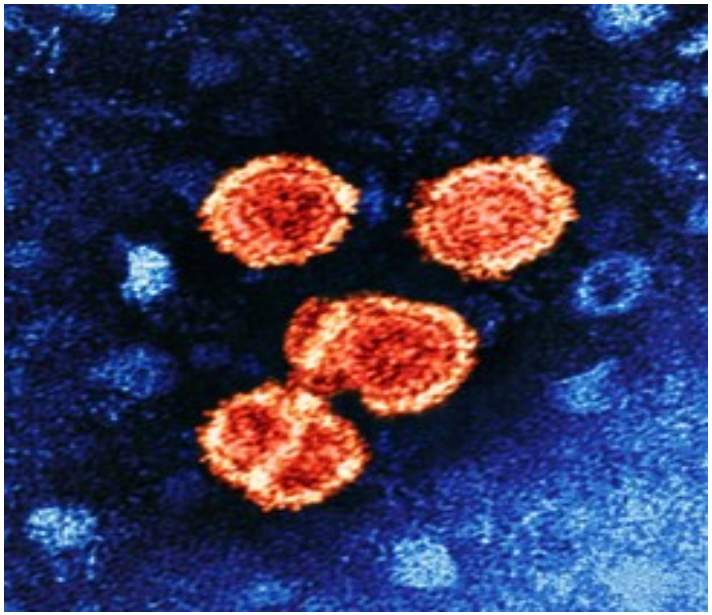
Basic Structure:

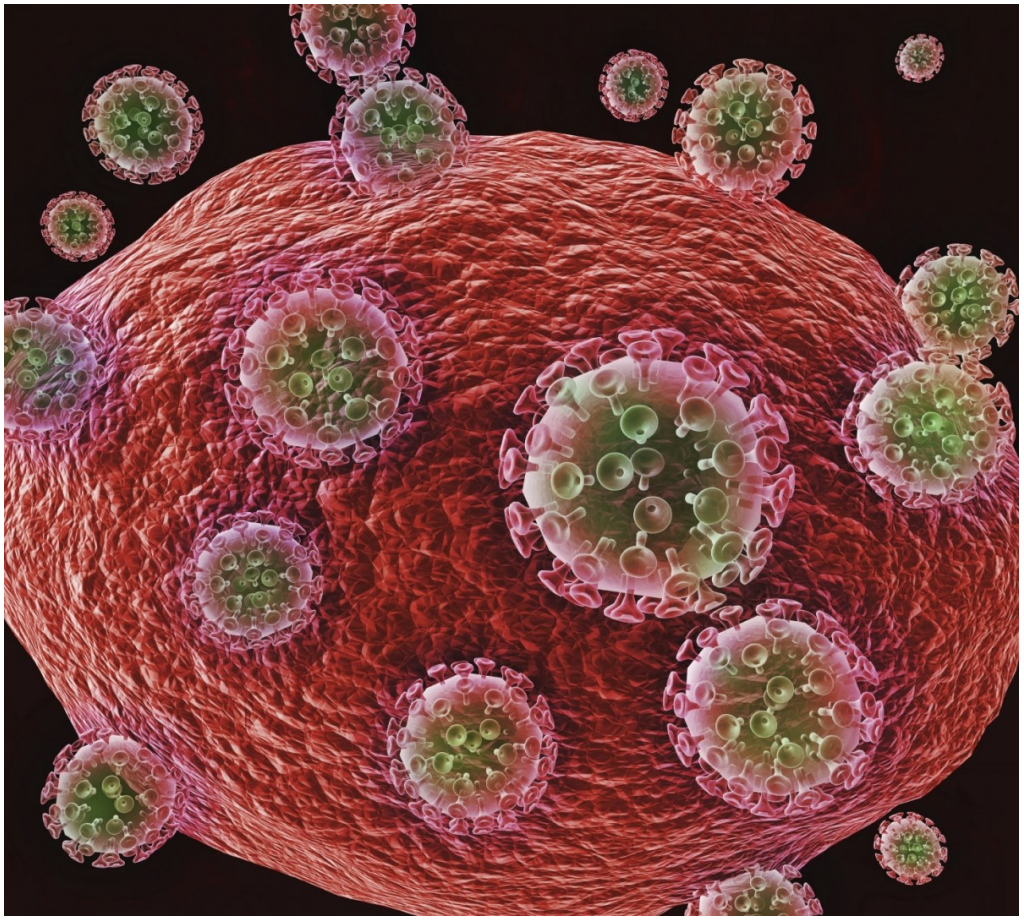
1- Genetic Material: Either DNA or RNA.

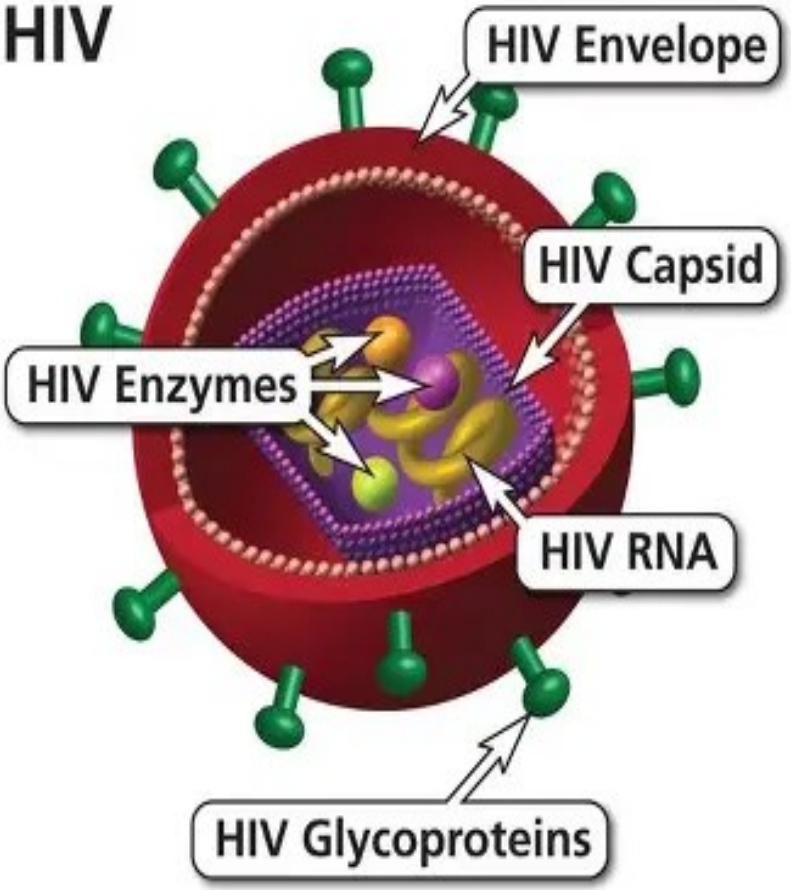
2- Protein Coat (Capsid): Protects the genetic material.

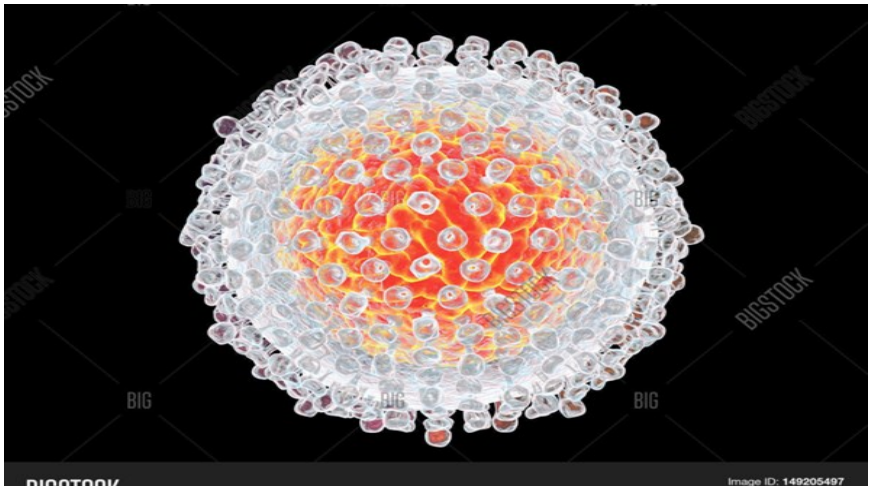
3- Lipid Envelope (in some viruses): E.g., HIV, Influenza.

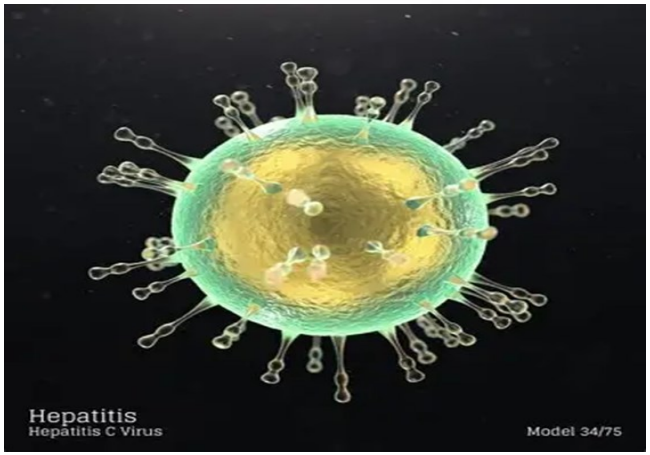












Hepatitis C Virus

Virus Morphology (Main Shapes)

What do we see under the Electron Microscope?

1- Icosahedral Shape: Like a football – Example: Adenovirus, Herpes virus.

2- Helical Shape: Rod-shaped or filamentous – Example: Measles virus, Rabies virus.

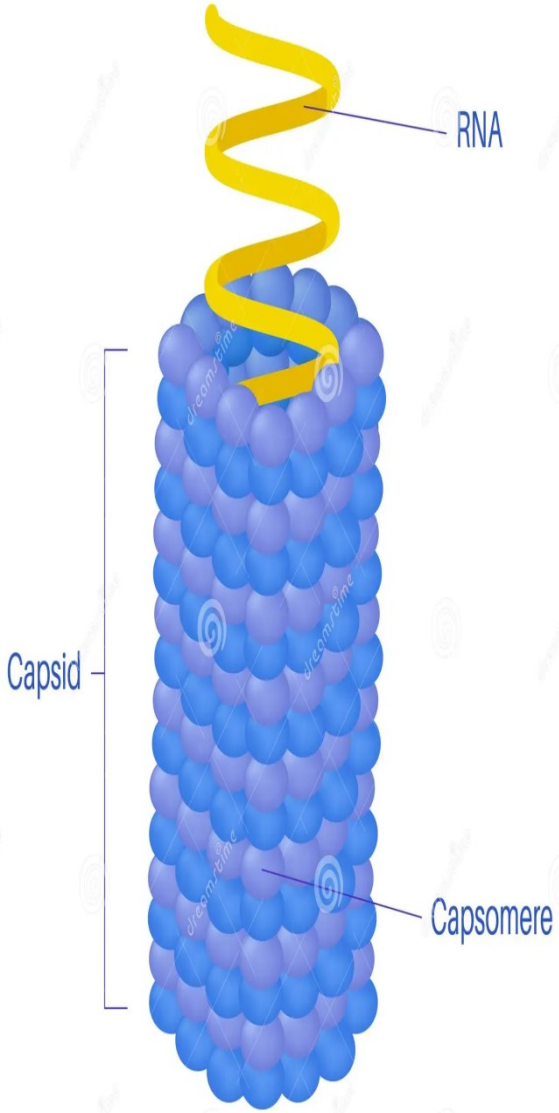
3- Complex Shape: Has additional structures – Example: Bacteriophage (has a head and tail).

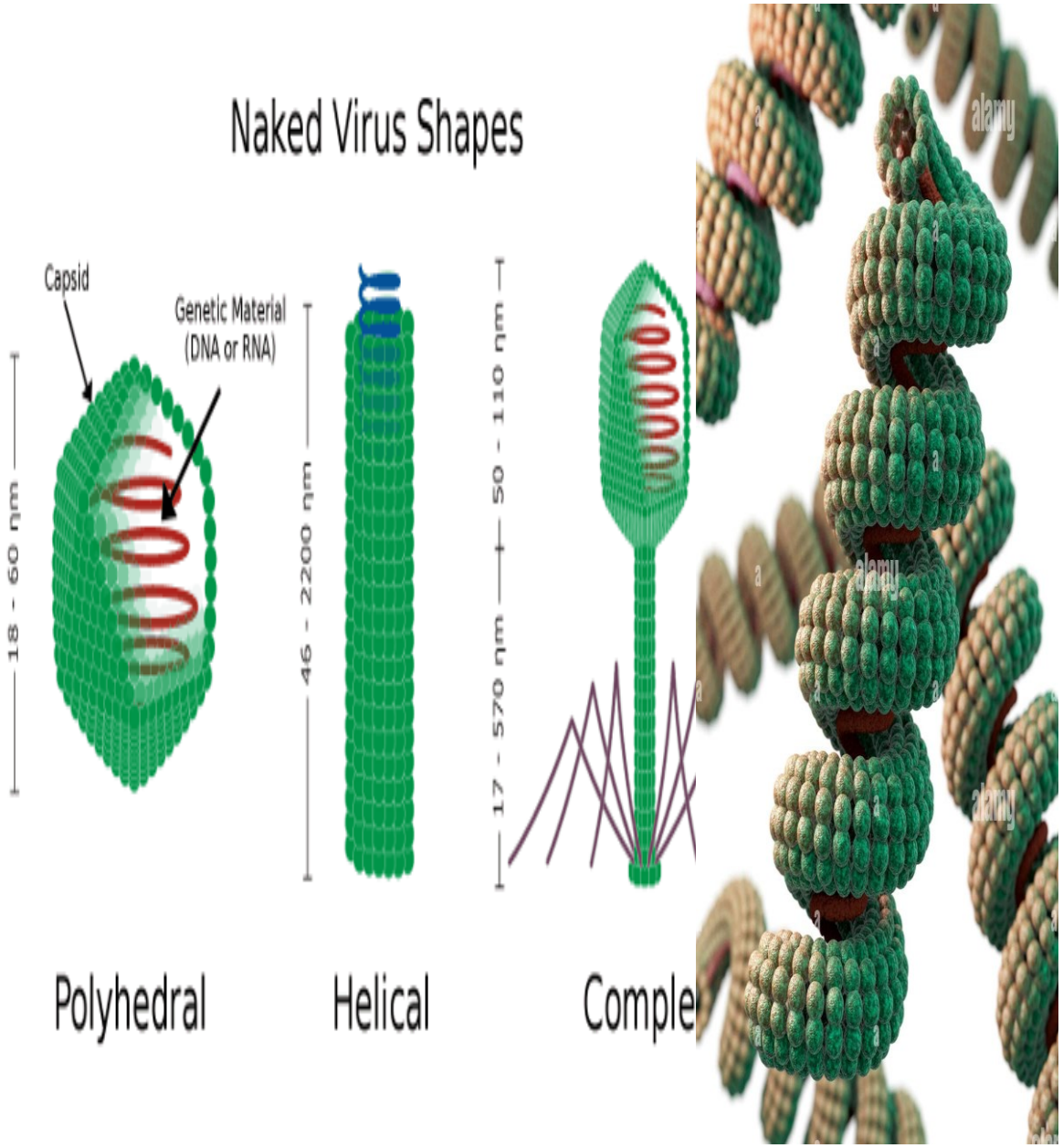
Practical Classification of Viruses (The Most Important Method)
We classify viruses practically based on the type of genetic material:

By Genetic Material:

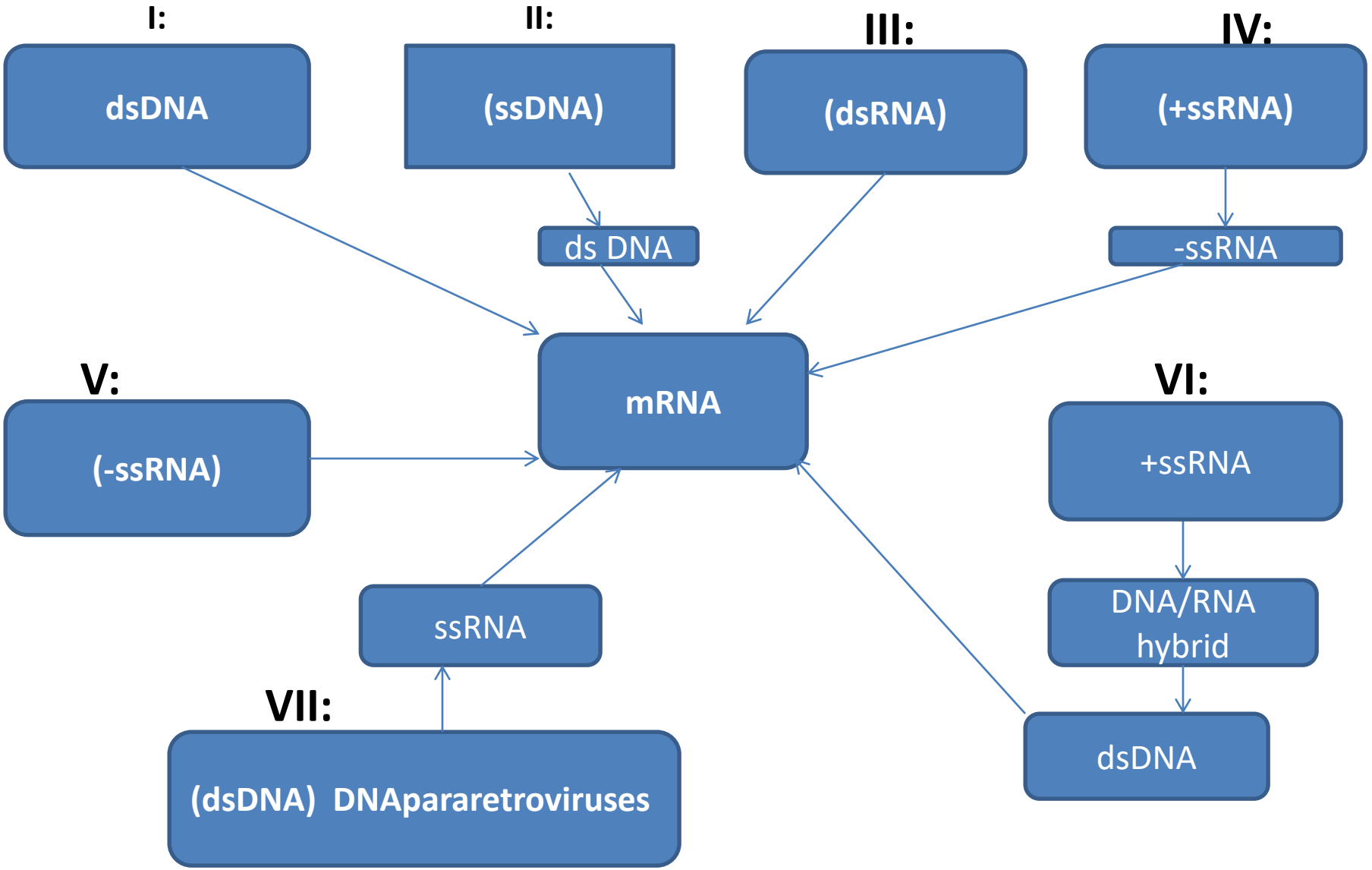
- **DNA Viruses (e.g., Herpes, Smallpox).**
- **RNA Viruses (e.g., Influenza, Coronavirus, Hepatitis C).**

HELICAL VIRUS





Baltimore Classification:



Viral Life Cycle (Very Briefly)

How does a virus replicate? It "hijacks" the cell!

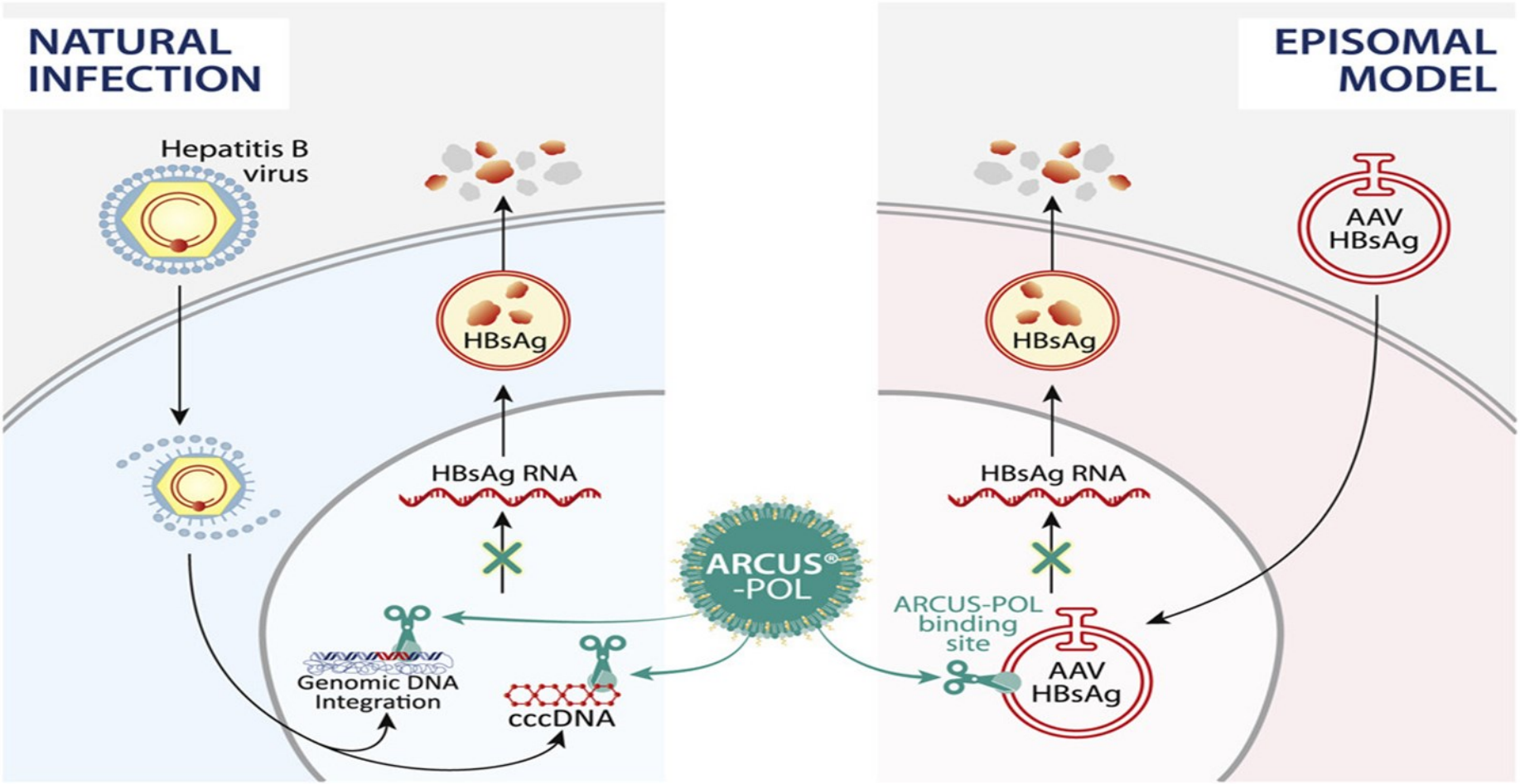
1- Attachment: Virus attaches to specific receptors on the host cell surface.

2- Penetration: Virus enters or injects its genetic material into the cell.

3- Replication & Synthesis: The host cell's machinery is used to make new viral parts based on the virus's genetic instructions.

4- Assembly: New viral components assemble to form new viruses.

5- Release: New viruses are released from the host cell (the cell may die or not).


NATURAL INFECTION
Hepatitis B virus
HBsAg
HBsAg RNA
Genomic DNA Integration
cccDNA
ARCUS® -POL
EPISOMAL MODEL
AAV HBsAg
HBsAg
HBsAg RNA
ARCUS-POL binding site
AAV HBsAg

Viral Diseases Relevant to Kidney and Public Health

1-Viral Hepatitis (B, C):

►**Causes chronic hepatitis, can lead to cirrhosis and liver failure.**

Special Relevance for You: Hemodialysis patients are at higher risk of infection. Strict infection control protocols are crucial.

2- Human Immunodeficiency Virus (HIV):

Can cause HIV-associated nephropathy.

3- Cytomegalovirus (CMV):

Important for kidney transplant recipients (immunosuppressed patients).

Common Viral Diseases

(1) - Respiratory System

1- Influenza Virus (RNA): Causes seasonal flu.

2- Rhinovirus (RNA): Main cause of the common cold.

3- Coronavirus (RNA): Causes colds, and COVID-19 (SARS-CoV-2).

4- Respiratory Syncytial Virus (RSV - RNA): Common in infants and the elderly.

Common Viral Diseases (

2) - Digestive System & Liver

- **Norovirus/Rotavirus (RNA): Cause acute gastroenteritis (severe diarrhea and vomiting).**
- **Hepatitis A Virus (HAV - RNA): Spread through contaminated food/water.**
- **Hepatitis B Virus (HBV - DNA): Spread through blood/body fluids, can cause cirrhosis.**

Common Viral Diseases

(3) - Nervous System & Skin

- **Rabies Virus (RNA): Fatal disease, transmitted through bites ofinfected animals.**
- **Measles Virus (RNA): Highly contagious disease causing a characteristic rash.**
- **Smallpox Virus (DNA): Eradicated globally through vaccination.**
- **Varicella-Zoster Virus (VZV - DNA): Causes chickenpox (varicella) and later shingles (herpes zoster).**

RABIES

1. Wash the wound with soap and water
2. You may need to get vaccined to prevent rabies (Post-Exposure Prophylaxis, PEP)

1. Make sure your pets' vaccination are up to date.
2. Don't let your pets roam without supervision.
3. Leave wildlife alone.

Rabies virus is transmitted through direct contact (such as through broken skin or mucous membrane in your eyes, nose or mouth) with saliva or brain / nervous system tissue from an infected animal.

Common Viral Diseases

(4) - Immunity & Cancer

- **Human Immunodeficiency Virus (HIV - RNA): Destroys immune cells, causing Acquired Immunodeficiency Syndrome (AIDS).**
- **Human Papillomavirus (HPV - DNA): Some types cause cervical cancer and other cancers.**
- **Epstein-Barr Virus (EBV - DNA): Causes infectious mononucleosis (mono), linked to some lymphomas.**

How We Fight Viruses (A Practical Introduction)

Prevention:

- **Vaccines: Our most powerful weapon (Measles vaccine, HPV vaccine, Flu vaccine).**
- **General Hygiene: Hand washing, use of sanitizers.**
- **Treatment (Difficult because viruses live inside our cells):**
  - **Antiviral Drugs: Disrupt a specific step in viral replication (e.g., drugs for Herpes, Influenza, HIV).**
- **Antibiotics have NO effect against viruses.**

Infection Control in Dialysis Units

♣**Why? Renal patients are often immunocompromised and more susceptible to severe viral complications.**

Key Strategies:

1- Vaccination (e.g., Hepatitis B vaccine).

2-Regular viral screening for new and existing dialysis patients.

3- Comprehensive sterilization of equipment and environment.

4- Use of single-use, disposable items.

5- Isolation protocols for febrile or suspected infectious patients.

- **Summary**
- **Viruses are microorganisms that cause a wide range of diseases.**
- **Some pose a specific threat to kidney patients, including those on dialysis or with transplants.**
- **Understanding their types and associated diseases is fundamental for prevention and infection control in clinical practice.**