Viruses

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Objectives of the lesson

- Explore the structure of viruses and their classification.
- Examine the viral life cycle, including replication and interaction with host cells.
- Discuss common viral diseases, modes of transmission, and prevention strategies.
- Explore antiviral medications, vaccines, and the challenges in studying and combating viruses.
- Highlight the importance of ongoing research and preparedness in the face of emerging viral threats.

Introduction

Viruses are microscopic infectious agents composed of genetic material—either DNA or RNA—encased in a protein coat called a capsid. Unlike living cells, viruses cannot carry out metabolic processes on their own and rely on host cells for replication.

Viruses play a significant role in various diseases affecting humans, animals, and plants. Understanding viruses is crucial for developing treatments, vaccines, and preventive measures. Viruses have a profound impact on global health, agriculture, and the environment.

WHAT ARE VIRUSES?

1. **Small Size**

Viruses are exceptionally tiny, typically **ranging from 20 to 300 nanometers** in diameter.

Their minuscule size makes them invisible to light microscopes, requiring electron microscopes for observation.

2. **Obligate Intracellular Parasites**

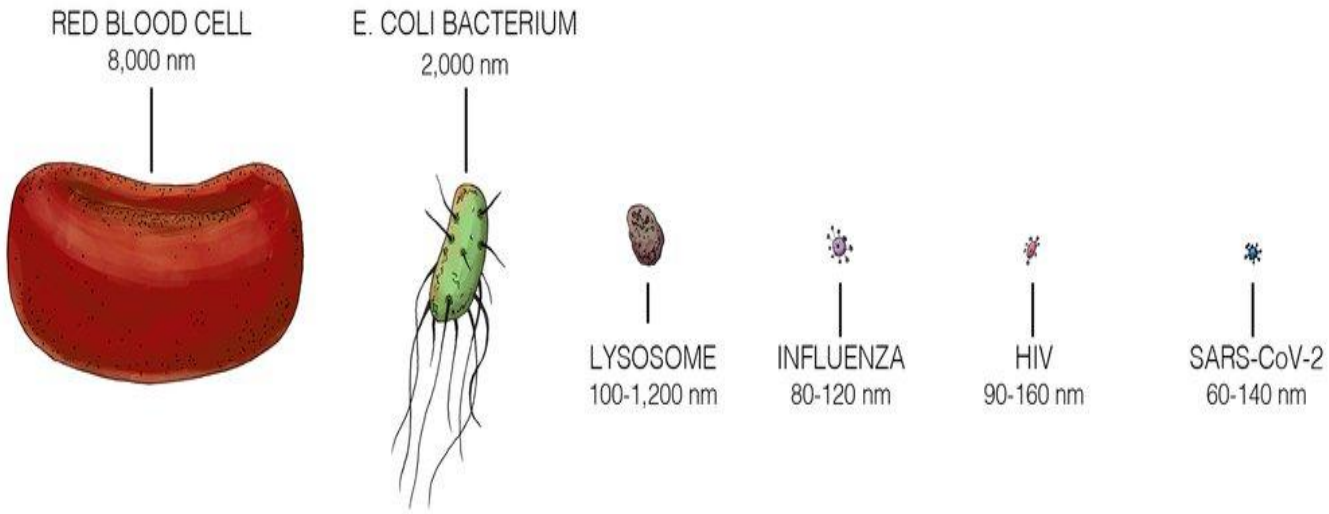
Viruses are **obligate intracellular parasites**, meaning they cannot carry out metabolic processes or reproduce outside a **host cell.**

They rely on the cellular machinery of the host organism to replicate and produce new viral particles.

3. **Genetic Material (DNA or RNA)**

Viruses carry genetic information in the form of either DNA (deoxyribonucleic acid) or RNA (ribonucleic acid).

This genetic material encodes the instructions for the virus to replicate and carry out its functions within the host cell.



STRUCTURE OF VIRUSES

1. **Capsid**

The capsid is the **protein shell** that surrounds and protects the genetic material of a virus.

2. **Envelope (if present)**

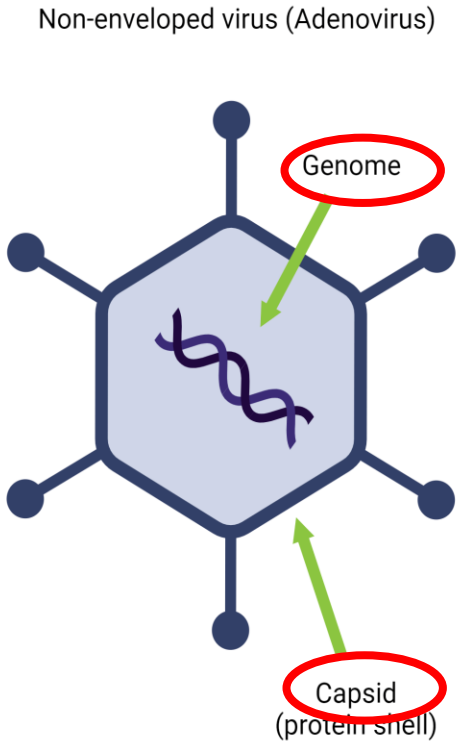
Some viruses have an additional **outer envelope derived from the host cell membrane.**

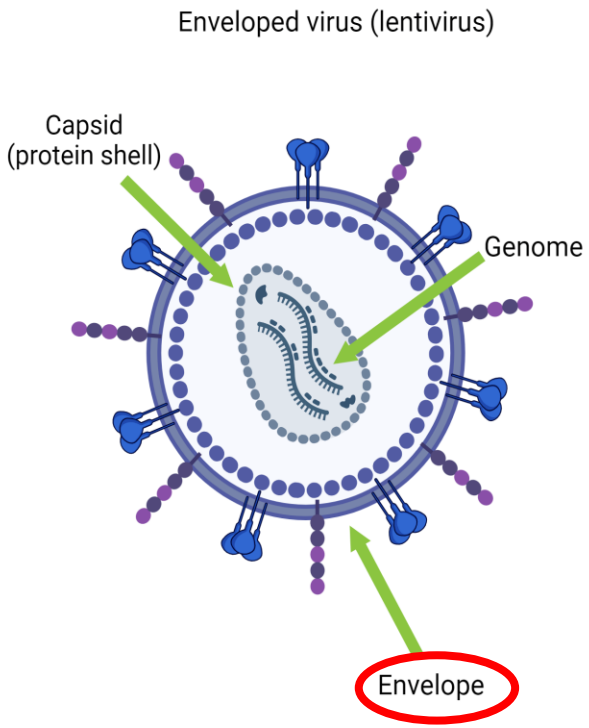
The envelope is often studded with viral proteins that play a crucial role in the virus-host interaction.

3. **Genome (genetic material)**

Viruses carry either DNA or RNA as their genetic material.

The genetic material contains the instructions necessary for the virus to replicate and produce new viral particles.





TYPES OF VIRUSES

1. **DNA Viruses (Viruses that contain DNA as their genetic material)**
   - Herpesviruses (e.g., Herpes simplex virus)
   - Adenoviruses
   - Papillomaviruses (e.g., Human papillomavirus)
2. **RNA Viruses (Viruses that contain RNA as their genetic material)**
   - Influenza virus, Hepatitis C virus

Examples of Common Viruses:

Influenza Virus

Causes seasonal flu and occasional pandemics.

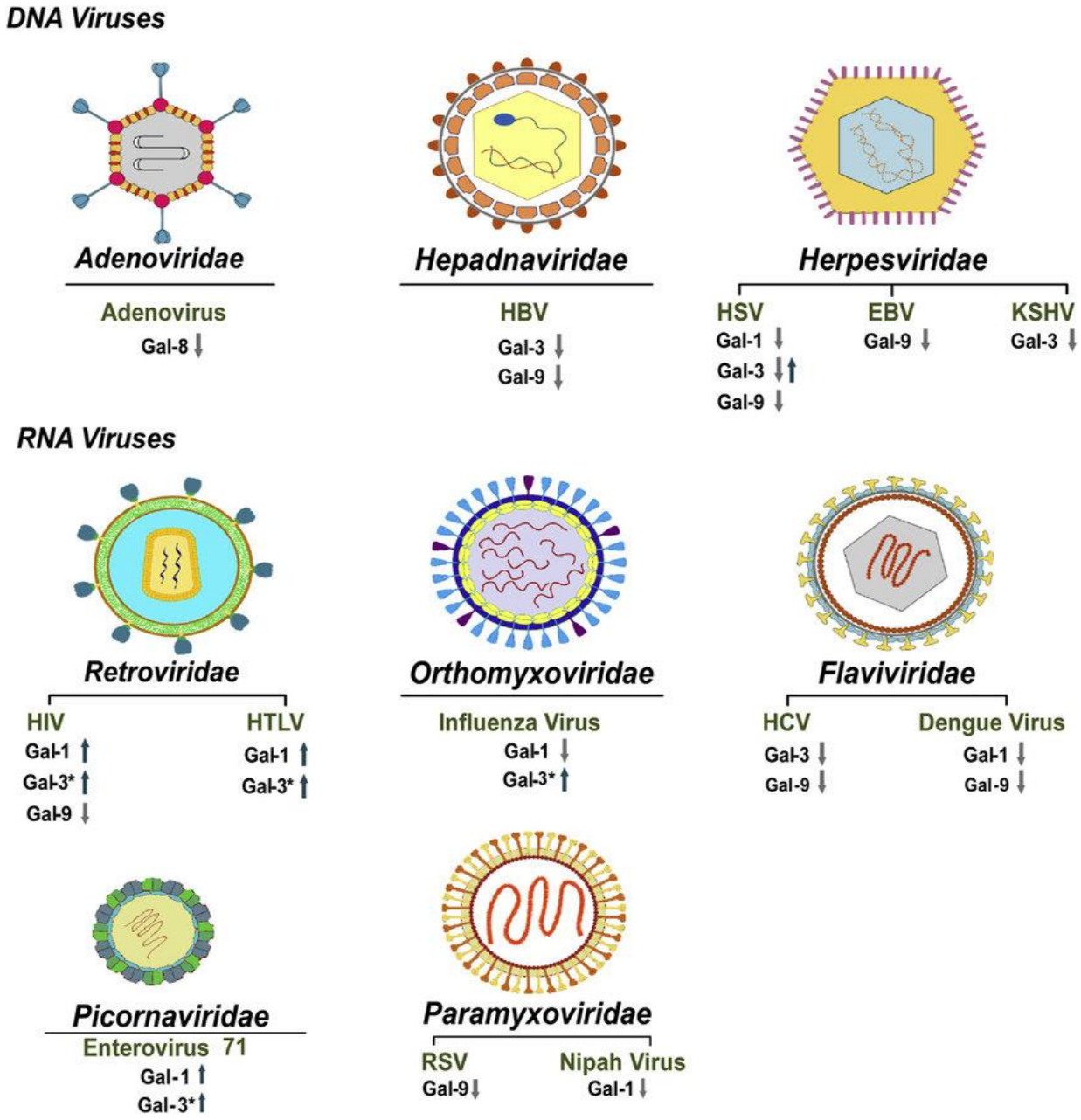
HIV (Human Immunodeficiency Virus)

İnsan bağışıklık yetmezliği virüsü

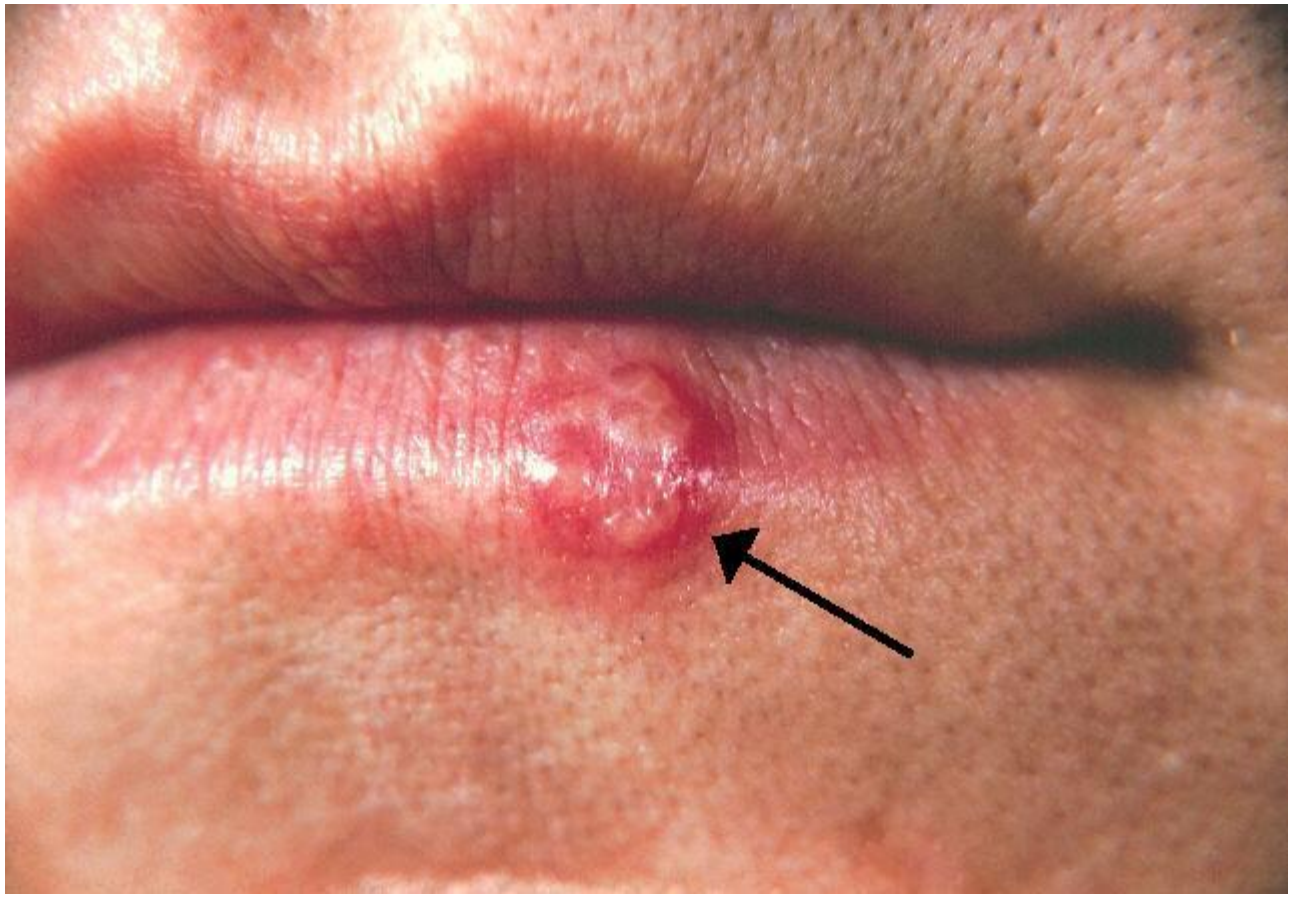
Leads to acquired immunodeficiency syndrome (AIDS).

Herpes Simplex Virus

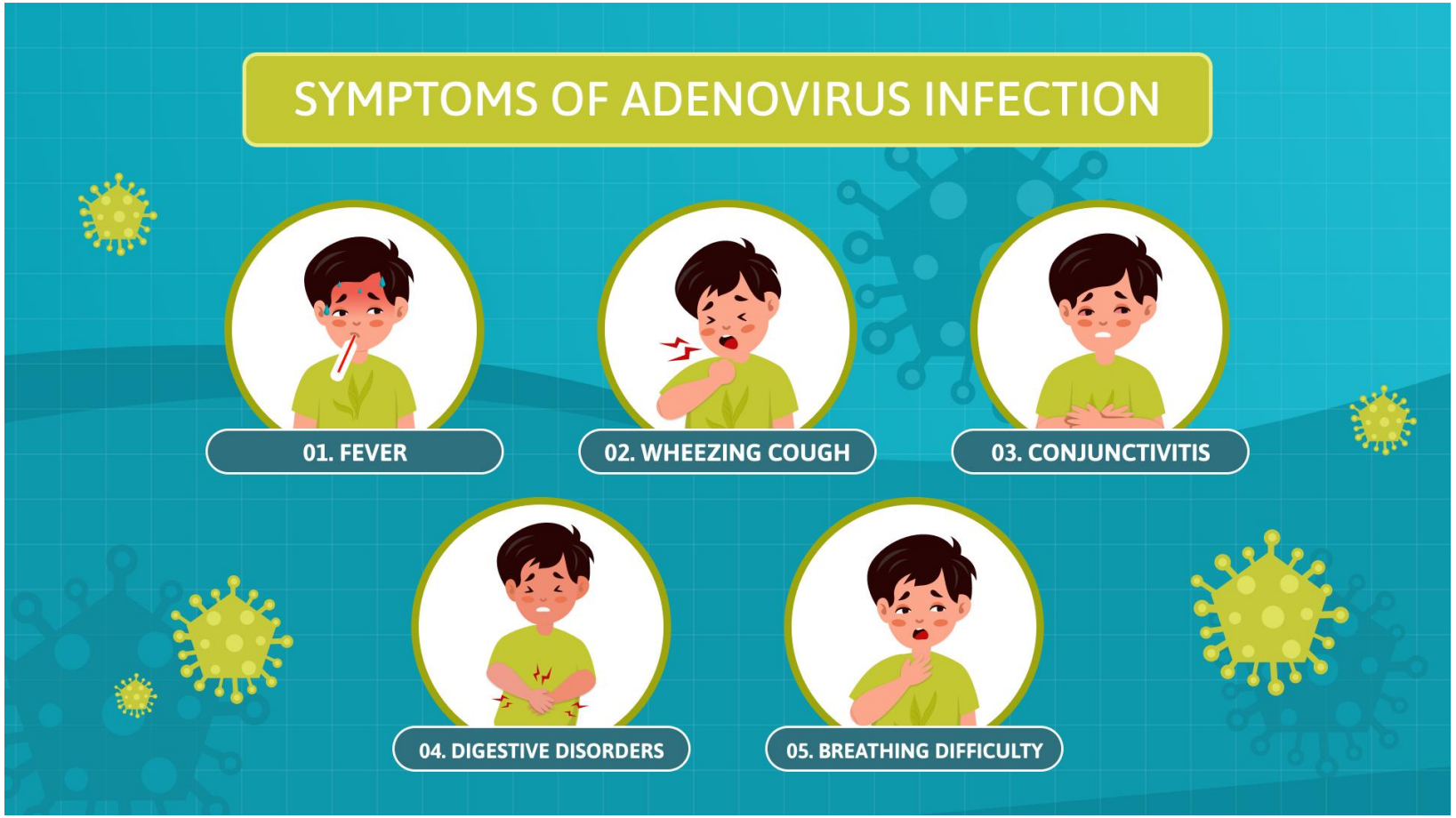
Causes oral and genital herpes infections.



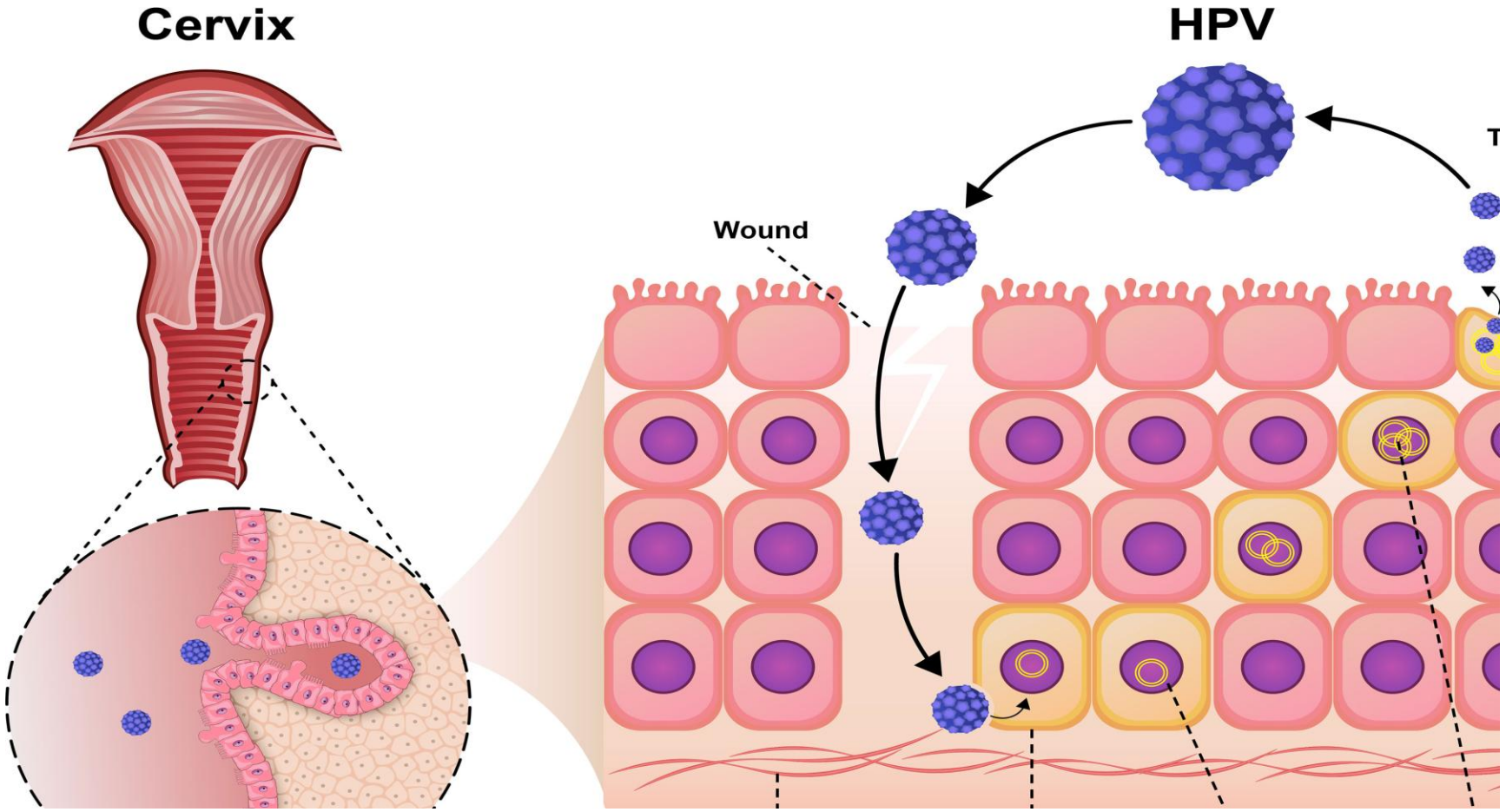
Herpes Virus



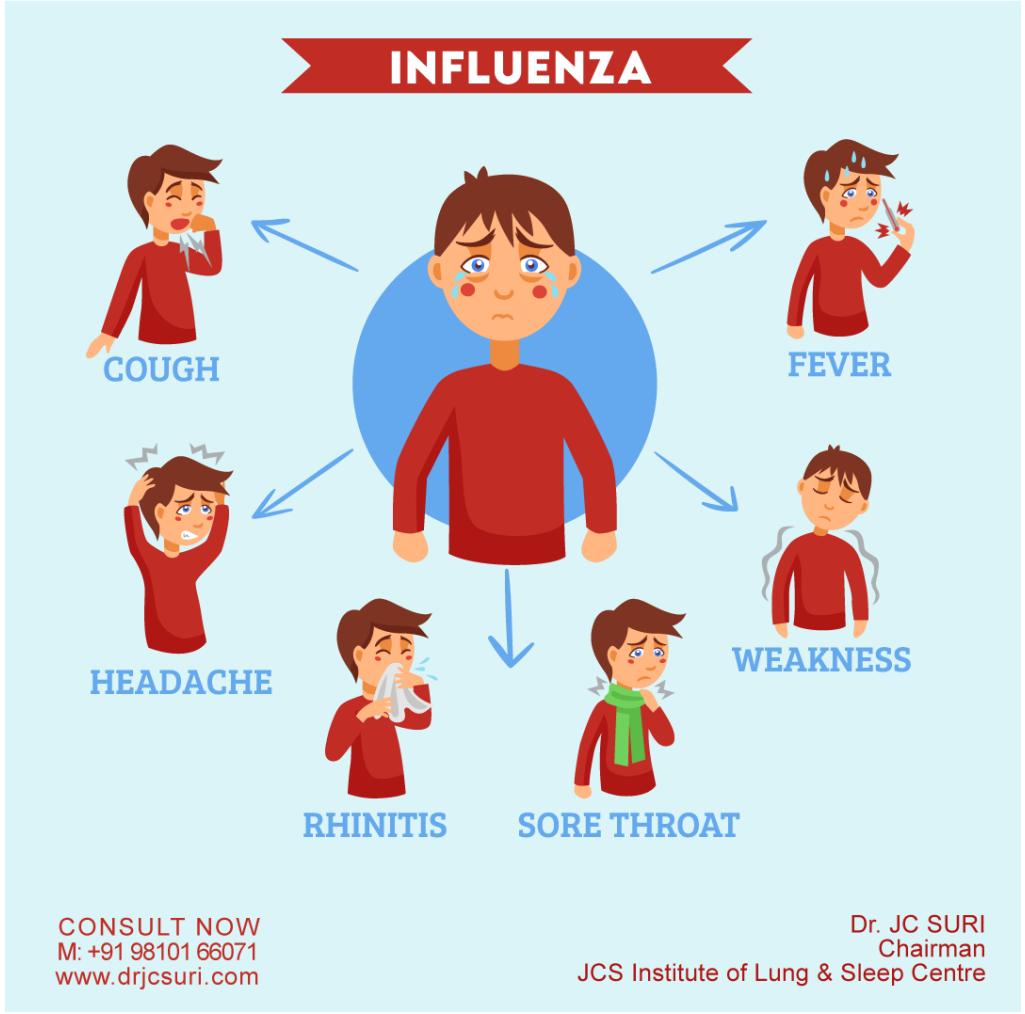
Adenovirus


SYMPTOMS OF ADENOVIRUS INFECTION
01. FEVER
02. WHEEZING COUGH
03. CONJUNCTIVITIS
04. DIGESTIVE DISORDERS
05. BREATHING DIFFICULTY

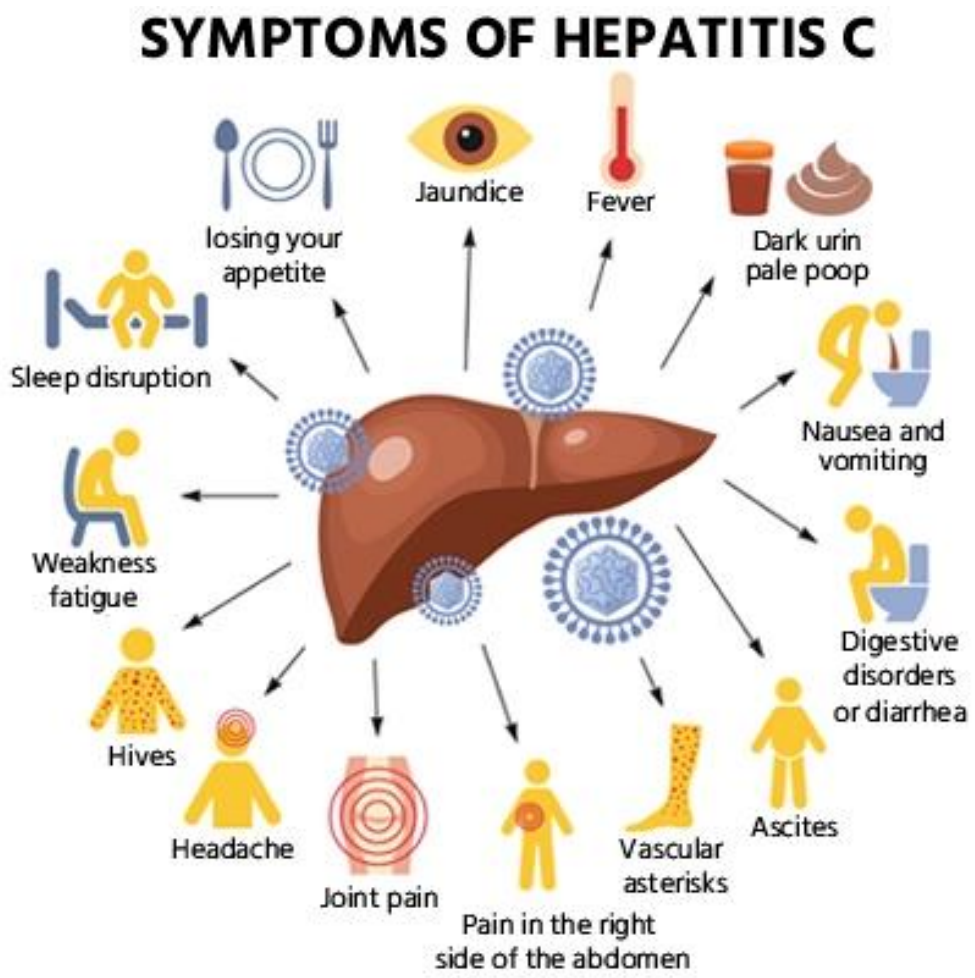
HPV (Human Papilloma Virus) can cause cancer in cervix



Influenza virus (Flu)



Hepatitis (A, B, C)

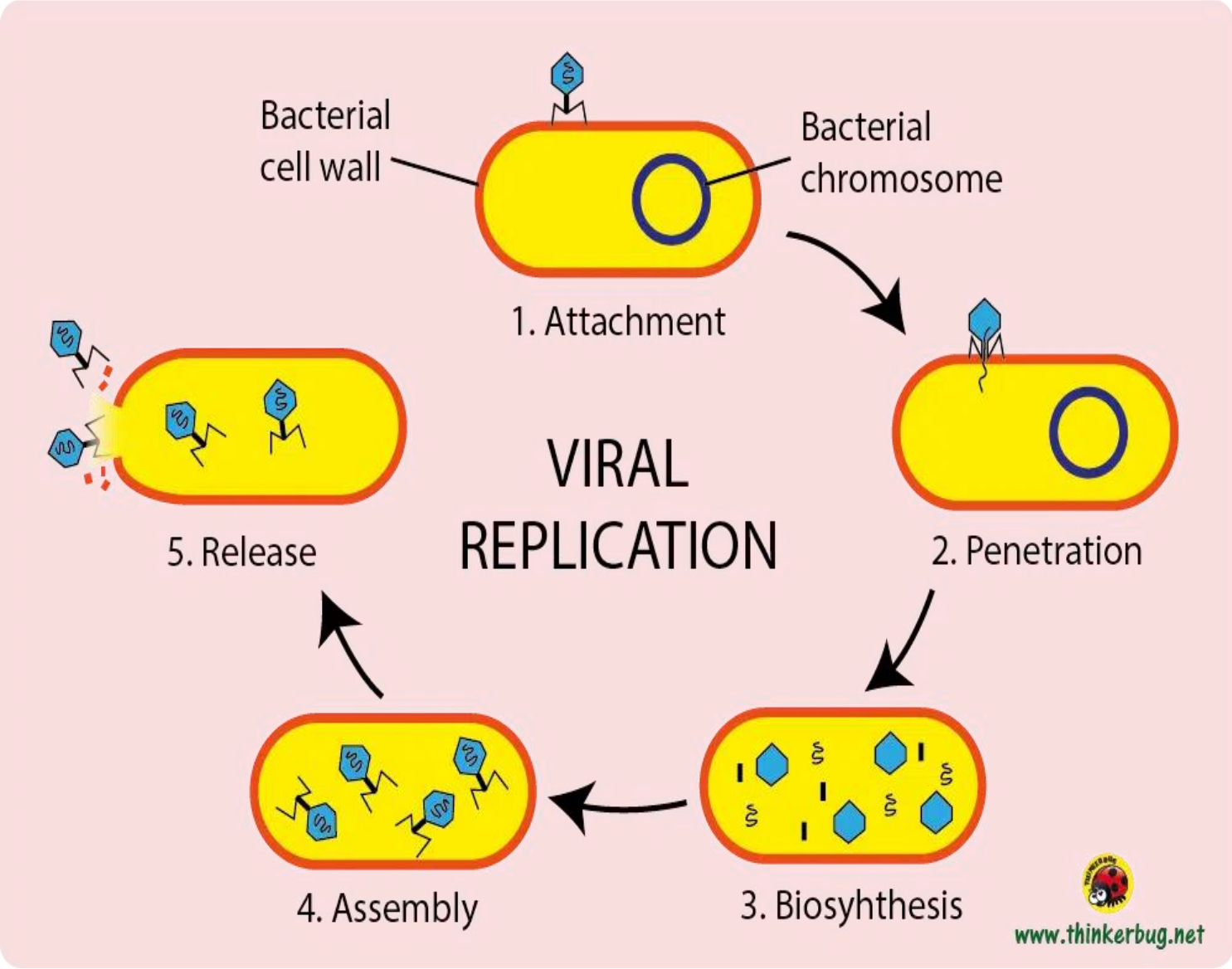


Viral Replication

1. **Attachment**
   - The virus recognizes and binds to specific receptors on the surface of the host cell.
   - Attachment is a crucial step for the virus to enter the host cell.
2. **Entry**
   - The virus enters the host cell, either through direct penetration, endocytosis, or fusion with the host cell membrane.
   - Once inside, the virus releases its genetic material into the host cell.
3. **Replication**
   - The viral genetic material takes control of the host cell's machinery.
   - The host cell's resources are utilized to replicate the viral genetic material and produce viral components.
4. **Assembly**
   - Newly synthesized viral components are assembled to form complete virions.
   - This often occurs in the host cell's cytoplasm or on its cell membrane.
5. **Release**
   - Newly formed virions are released from the host cell, either through cell lysis or budding.
   - Released virions can then infect new host cells and continue the cycle.

Viral Replication

1. Attachment
2. Entry (Penetration)
3. Replication (Biosynthesis)
4. Assembly
5. Release



Virus-Host Interaction

Attachment and Entry

Viruses use specific receptors on the host cell surface for attachment.

Manipulation of Host Machinery

Viral genetic material takes control of host cell machinery.

The virus utilizes host cell resources for replication and assembly.

Impact on Host Cell Function

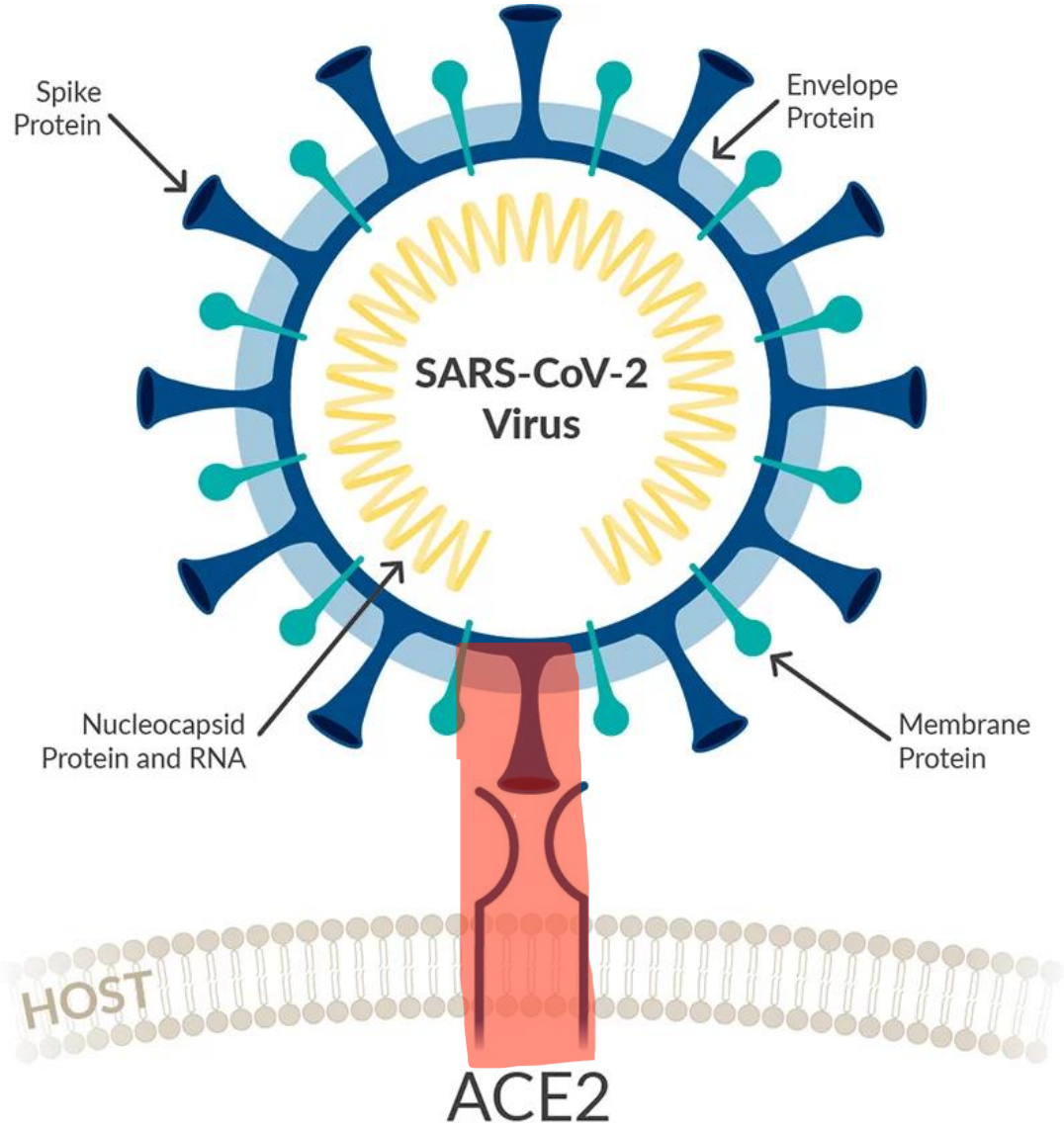
Viral replication may disrupt normal cellular functions.

Cell damage or death can occur, depending on the severity of infection.

Immune Response

The host immune system recognizes viral infections and mounts a response.

Immune response can lead to symptoms such as fever, inflammation, and other signs of infection.



Transmission of Viruses

Airborne Transmission

Viruses can spread through respiratory droplets released when an infected person talks, coughs, or sneezes.

Examples include influenza and COVID-19.

Direct Contact

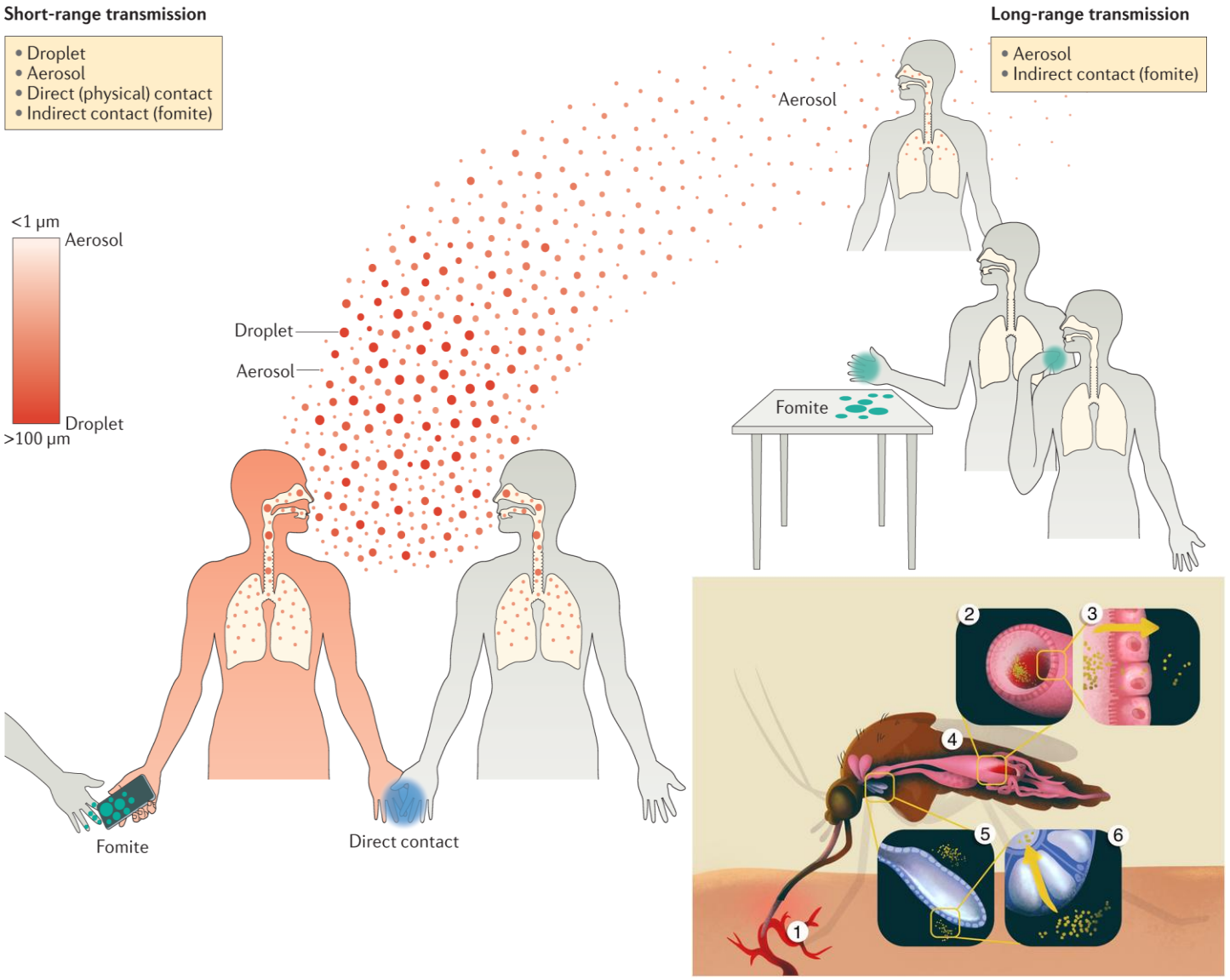
Transmission occurs through physical contact with an infected person, their bodily fluids, or contaminated surfaces.

Examples include herpes simplex virus and the common cold.

Vector-Borne Transmission

Some viruses are transmitted by vectors such as mosquitoes or ticks.

Examples include Zika virus (mosquito-borne) and Lyme disease (tick-borne).



Antiviral Medications

- Recall our discussion about bacteria, where we emphasized that antibiotics prove ineffective against viruses due to the absence of cellular organization in viruses. Unlike bacteria, viruses lack cells altogether. Antibiotics, as the name suggests, are anti-life agents designed specifically to combat bacteria, which are living organisms.
- To target viruses scientists have produced a lot of antiviral medications. These medications target specifically viruses.

Vaccines

Importance of Vaccines in Preventing Viral Infections

Disease Prevention

Vaccines stimulate the immune system to recognize and fight specific viruses.

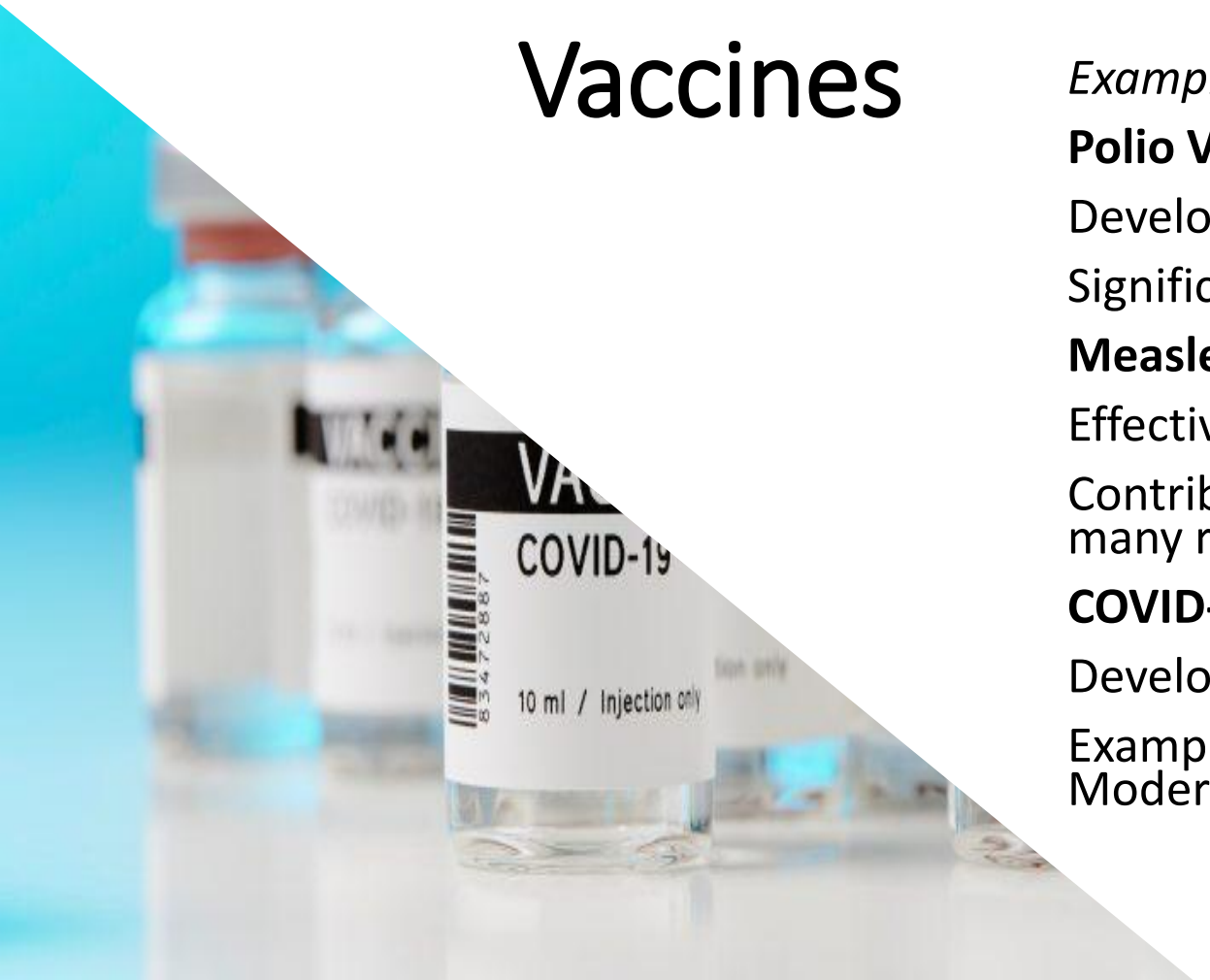
Prevent the development of diseases caused by viral infections.

Community Immunity (Herd Immunity)

High vaccination rates protect vulnerable individuals who cannot receive vaccines.

Reduces the spread of infectious diseases within a community.

Vaccines



Examples of Successful Viral Vaccines

Polio Vaccine

Developed by Jonas Salk and Albert Sabin.

Significantly reduced the global incidence of polio.

Measles, Mumps, and Rubella (MMR) Vaccine

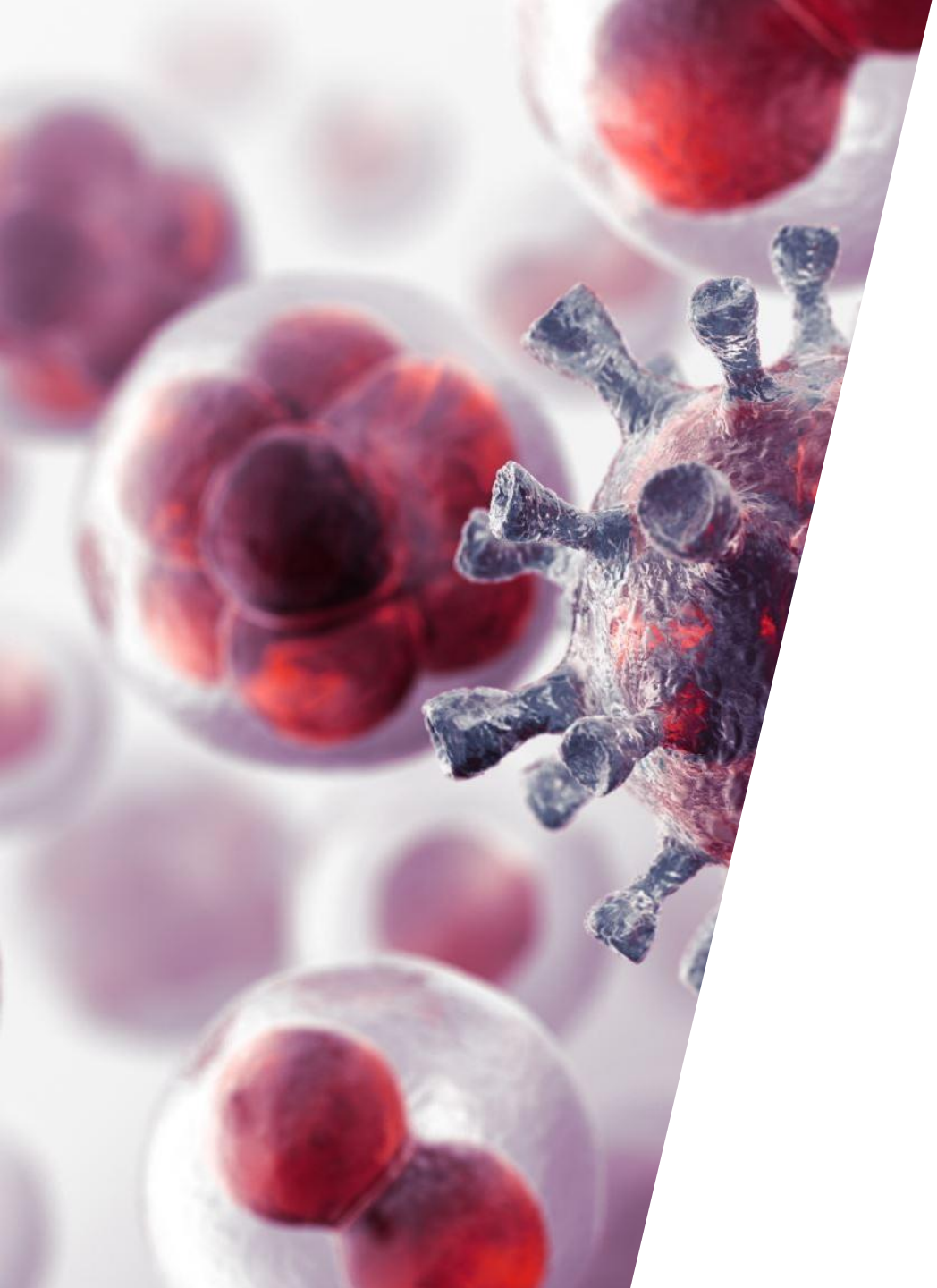
Effective against three viral infections.

Contributed to the near-elimination of these diseases in many regions.

COVID-19 Vaccines

Developed to combat the SARS-CoV-2 virus.

Examples include vaccines from Pfizer-BioNTech, Moderna, and Johnson & Johnson.



Emerging Viral Threats

Recent or Potential Viral Outbreaks

Zoonotic Transmissions

Viruses can jump from animals to humans, leading to novel infections.

Examples include Ebola, SARS-CoV, and MERS-CoV.

Globalization and Travel

Rapid spread of viruses due to increased international travel.

Examples include the rapid spread of COVID-19.

Vaccines

https://www.youtube.com/watch?v=4SKmAlQtAj8