Explain - Viruses & Characteristics of Life Notes Key
FALL SEMESTER 2024

INSTRUCTOR:

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Vocabulary / Key Terms/ Concepts	Viruses & Characteristics of Life Notes
• *Bacteriophage* • *Capsid* • *Chicken Pox* • *DNA Virus* • *Evolve Over Time* • *Genetic Material*	**Student Expectations:** • ***Identify and Describe -*** *the basic structure of a virus, including the terms capsid, genetic material (DNA or RNA), and, if applicable, lipid envelope.* • ***Detail*** *the steps of the lytic cycle in viral replication and explain the significance of each step.* • ***Identify and Describe*** *the steps of the lysogenic cycle in viral replication and discuss the conditions under which it may shift to the lytic cycle.* • ***Contrast the lytic and lysogenic cycles,*** *highlighting their differences and the implications for the host organism.* • ***Compare and contrast*** *the characteristics of living and non-living things, using viruses as a focal point.*

- *Genome*
- *Grow and Develop*
- *Herpes*
- *Host*
- *Human Immunodeficiency Virus (HIV)*
- *Infect*
- *Influenza*
- *Lysogenic Cycle*
- *Lytic Cycle*
- *Made of Cells*
- *Maintain Homeostasis*
- *Obtain and Use Energy*
- *Pathogen*

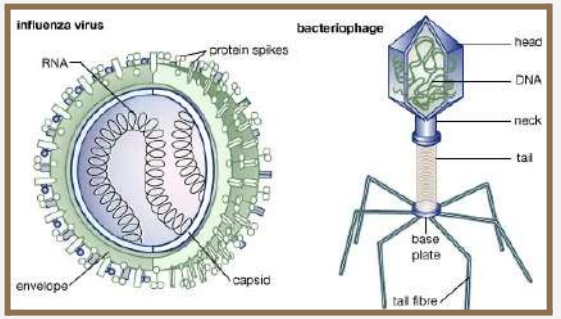
- ***Explain*** *how viruses differ from living organisms in terms of metabolism, growth, and self-replication.*
- ***Identify and explain*** *the components of epidemiology and their roles in understanding and controlling virus spread.*
- ***Describe*** *the global implications of virus spread, using a specific example such as the COVID-19 pandemic, and discuss the epidemiological responses implemented.*

I. What is a Virus?

A. A virus is a tiny germ that can make you sick. It's not alive like plants or animals.

B. Parts of a virus:

1. **Capsid**: This is like a shell that protects the virus.
2. **Genetic material**: This is like a recipe that tells the virus how to make more of itself.
3. Lipid **envelope** (if applicable): Some viruses have a coat made of fat.



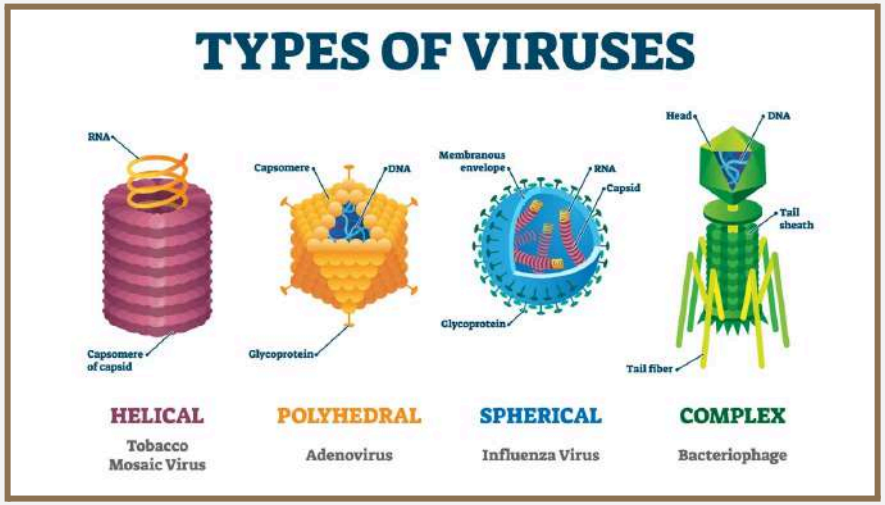
C. Types of Viruses by **Shape**

1. **Spherical** Viruses
   - **a. Description**: These viruses are roughly spherical or round in shape.
   - **b. Examples**: Influenza virus, Adenovirus
2. **Helical** Viruses
   - **a. Description**: These viruses have a helical or spiral shape, resembling a spring.

- *Reproduce*
- *Respond to Environment*
- *Retrovirus*
- *RNA Virus*
- *Vaccine*
- *Viral Dormancy*
- *Virus*

b. Examples: Tobacco mosaic virus, Ebola virus

3. **Icosahedral** Viruses
   - **a. Description**: These viruses have a roughly spherical shape with 20 triangular faces.
   - **b.** Examples: Poliovirus, Herpes simplex virus
4. **Complex** Viruses
   - **a.** Description: These viruses have a complex structure that does not fit into the other categories.
   - **b.** Examples: T4 bacteriophage, Vaccinia virus

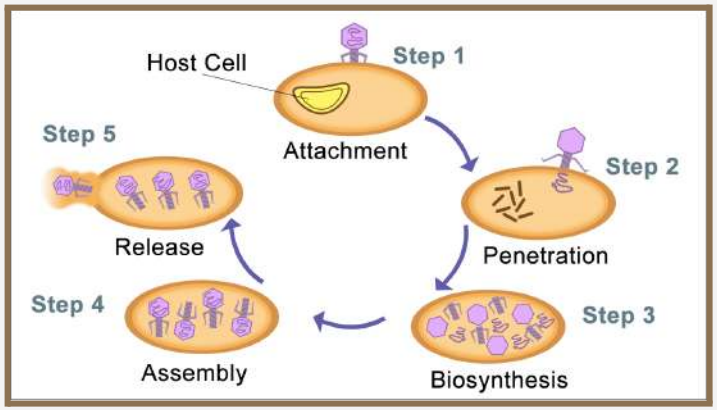


II. How Viruses Make More of Themselves: The Lytic Cycle

A. When a virus infects a cell, it uses the cell to make copies of itself.

B. Steps of the lytic cycle:

1. **Attachment**: The virus sticks to the cell.
2. **Penetration**: The virus gets inside the cell. **DNA** or **RNA**, depending on the virus type enters the **host** cell.
3. **Biosynthesis**: The virus makes copies of itself using the cell's machinery.
4. **Maturation**: New viruses are put together.



5. **Release**: The cell bursts and new viruses go out to infect other cells.

C. Examples:

1. Influenza
2. Ebola
3. Covid-19

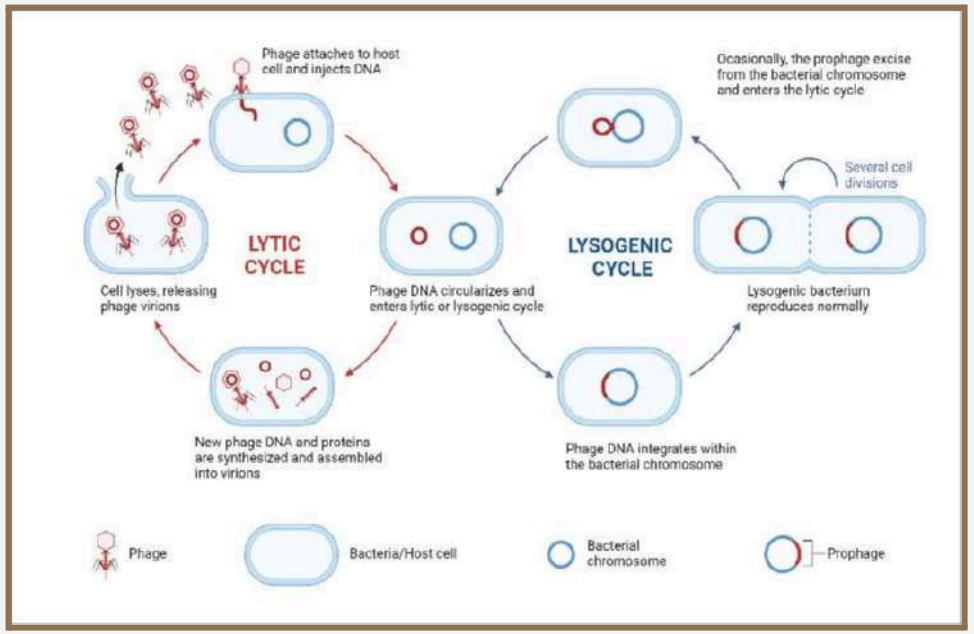
III. How Viruses Can Stay Hidden: The Lysogenic Cycle

A. Sometimes, a virus can hide in a cell and **does not** make copies right away.

B. Steps of the **lysogenic cycle**:

1. **Attachment** and **Penetration**: The virus gets into the cell.
2. **Integration**: The virus puts its genetic material into the cell's DNA.

3. **Dormancy**: The virus stays **quiet** and doesn't make copies of **itself**, but the cell undergoes constant **cell division** making **copies** of the **viral genetic material** in each new **cell**.
4. **Activation**: Something triggers the virus - **Lytic cycle** begins: start making copies and cause illness.



C. Examples:

1. HIV
2. Herpes

IV. How Viruses Are Different from Living Things

A. Living Things:

1. **Cells:** all living things are made of cells/cells are the basic unit of life, viruses are not made of cells
2. **Metabolism**: Living things use food for energy, but viruses don't.
3. **Growth**: Living things grow bigger, but viruses only make more copies of themselves.

4. **Reproduction**: Living things can make babies, but viruses need **HOST** to make more of themselves.
5. **Response to stimuli:** living organisms respond to their environment, viruses do not.
6. **Homeostasis**: living things maintain a stable internal environment, but viruses can not.

B. Non-living Things:

1. **Genetic Material:** Viruses have genetic material (DNA / RNA) like living things.
2. **Adaptation / Evolution**: Viruses can change to continue infection similar to living things' actions to survive.

V. How We Study and Control Viruses: Epidemiology

A. Epidemiology helps us understand how diseases spread and how to stop them.

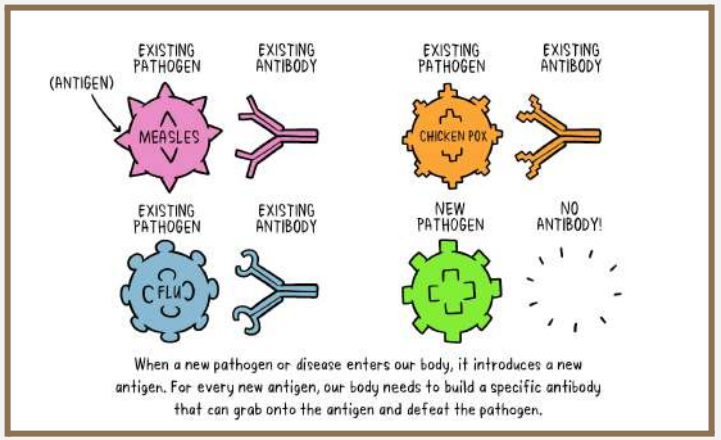
B. Parts of Epidemiology:

1. **Watching for Sick People**: We keep an eye on people getting sick.
2. **Finding the Source**: We try to figure out where the sickness started.
3. **Prevention**: We use things like vaccines to stop the sickness from spreading.
    a. **What are Vaccines?**
        1) **Definition**: Vaccines are substances that stimulate the immune system to produce **antibodies**, providing immunity against specific diseases.
        2) **Purpose**: Vaccines help **prevent** the spread of infectious diseases by creating **immunity** without causing the disease itself.
        3) How Vaccines Work:

a) Vaccines contain **weakened** or **inactive** parts of a **virus** or bacteria.

b) When the vaccine is administered, the **immune system recognizes** these parts as foreign and produces **antibodies** to fight them.

c) **Memory cells** are also created, which remember the **pathogen** and can quickly produce **antibodies** if **exposed** to the actual **virus** or bacteria in the future.



4) **Components of Vaccines:**

a) **Antigens**: These are the parts of the virus or bacteria that stimulate the immune response.

b) **Stabilizers**: These help maintain the **effectiveness** of the vaccine during **storage** and **transportation**.

c) **Preservatives**: These prevent contamination of the vaccine.

5) **Effectiveness of Vaccines**:

a) Many Vaccines are **highly effective** at **preventing diseases** and their complications.

b) Some vaccines may require **booster doses** to maintain immunity over time.

c) Vaccine effectiveness can vary depending on factors such as the individual's **age**, **health** status, and the specific **vaccine**.

6) **Immunity and Vaccination:**

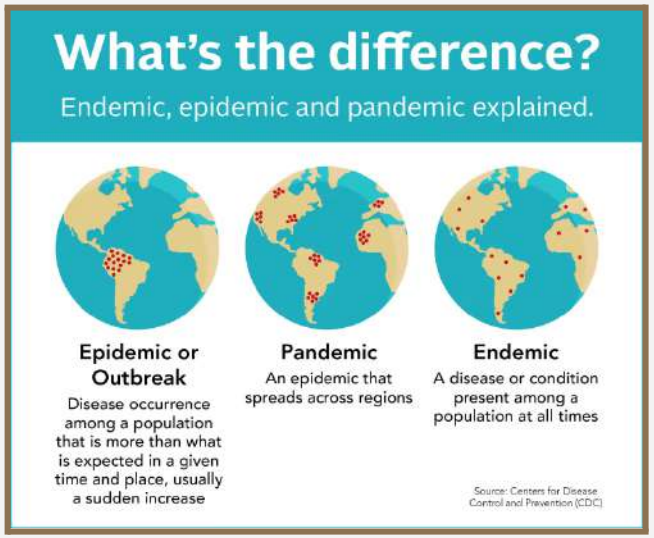
a) Vaccination helps create **immunity** by **stimulating** the immune syst**e**m to produce **antibodies**.

b) Immunity can be achieved through **vaccination** or by **recovering** from the disease **itself**, but vaccines (depending on the virus) are safer and more effective.

c) **Herd immunity** is achieved when a **sufficient** portion of the **population** is **immune** to a disease, **reducing** the **spread** of the disease and **protecting** those who are **not immune**.

C. How do Viruses Spread – Epidemiology

1. **Outbreak:** An outbreak is the **sudden** occurrence of a **disease** in a **specific time** and **place**, **affecting** a greater **number** of **people** than expected.
2. **Epidemic:** An epidemic occurs when a **disease spreads rapidly** and extensively among a **population**, affecting a **large** number of **people** within a **community** or **region**.



	3. **Pandemic:** A pandemic is an epidemic that has **spread** over **several countries** or **continents**, affecting a large number of people worldwide. 4. **Endemic:** A disease is considered endemic when it is **constantly present** in a particular **population** or **region**. **D. Global Impact of Viruses**: 1. **Example: COVID-19 pandemic.** 2. **Effects**: COVID-19 changed how we live, work, and experience school. 3. **Response**: People wore masks, stayed home, and got vaccinated to stop the virus from spreading. A virus is a tiny germ that can make you sick. It's not alive like plants or animals. Viruses have different parts, like a shell called a capsid that protects them, genetic material that tells them how to make more of themselves, and sometimes a coat made of fat. Viruses can make more of themselves using a process called the lytic cycle, where they infect a cell, make copies of themselves, and then burst out to infect other cells. They can also hide in a cell and not make copies right away, which is called the lysogenic cycle. Viruses are different from living things because they don't have cells, they can't use food for energy, and they don't grow or reproduce on their own. They also can't respond to their environment or maintain a stable internal environment like living things can. However, viruses do have genetic material like living

	things, and they can change over time to continue infecting new cells, which is similar to how living things evolve. We study and control viruses using a field called epidemiology, which helps us understand how diseases spread and how to stop them. We use vaccines to prevent the spread of infectious diseases. Vaccines stimulate the immune system to produce antibodies, providing immunity against specific diseases. This helps create immunity without causing the disease itself. Vaccines contain weakened or inactive parts of a virus or bacteria, which help the immune system recognize and fight the virus in the future. Overall, viruses can have a big impact on our health and lives, as seen with the COVID-19 pandemic. It's important to understand how viruses work and how we can prevent and control them to stay healthy.
Notes Summary