**Life Sciences 11 Microbiology: Viruses Date:**

**Objectives - By the end of the lesson you should be able to:**

* Classify viruses as living or non-living
* Describe the structure of a virus
* Explain how a virus infects a host
* Compare and contrast the lytic and lysogenic cycles of viral reproduction
* Describe different types of viruses
* Explain human responses to viral infections

**Introduction**

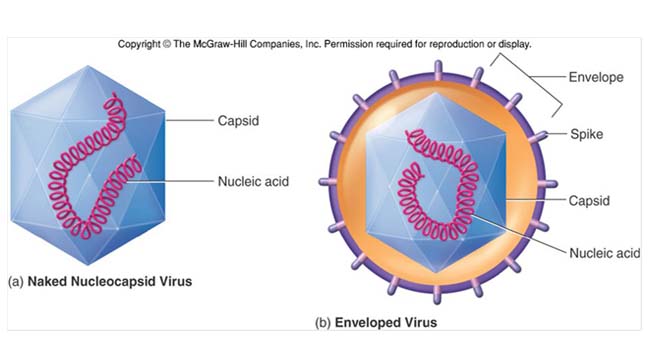
* Viruses are not included in any of the Domains or Kingdoms of life. Why?

**The 8 Characteristics of Life (Review)**

* 1. All life is made up of at least one or more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* 2. All life must obtain and use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (metabolism)
* 3. All life grows – increasing its biomass as it develops
* 4. All life reproduces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* 5. All life responds to its environment
* 6. All life adapts - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to survive in its environment over generations
* 7. All life maintains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (stable internal environment)
* 8. All life is based on a universal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Viruses…..Life?**

* They \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ all of the characteristics of life
* Viruses are not cells and do not contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or any other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* They can’t do any of the chemistry of life (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) by themselves
* They can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rehydrated, and still be infectious
* Viruses contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ …which can mutate and evolve just like ours!
* Viruses cause diseases which can be contagious
* Viruses can reproduce, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - they force a host cell to help!

**So what are viruses?**

* They are very tiny particles (*seen only with an electron microscope*) that have some of the properties of life
* **Definition:** an infective agent that typically consists of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, is too small to be seen by light microscopy, and is able to multiply only within the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

***Discovery of Viruses***

* By Dimitre Ivanowski - experimented with Tobacco Mosaic Disease
* Knew a pathogen was involved but couldn’t see it!
* Did 3 experiments
* *Experiments:*

1: Extracted juice from diseased leaves and spread on healthy leaves

- Healthy leaves became diseased

2: Boiled the diseased juice then placed it on healthy leaves

- Healthy leaves did NOT become diseased

3: Passed the unboiled diseased juice through a fine porcelain filter (too small for any life, even smallest bacteria, to get through) then place filtrate onto healthy leaves

- Healthy leaves became diseased!

*Martinus Beijerinck*

* Suggested that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the juice caused the disease
* Called these particles \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Wendell Stanley's Experiment:*

* Left the filtrate sitting out overnight and water evaporated away and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ formed. Added water back to dissolve the crystals and placed this solution on healthy leaves

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Experimental Conclusions:*

Ivanowski Stanley

1. Disease was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Disease caused by something \_\_\_\_\_\_\_\_\_\_\_

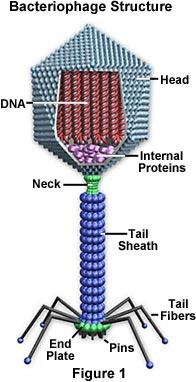
2. Disease was caused by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it could be crystallized and all life

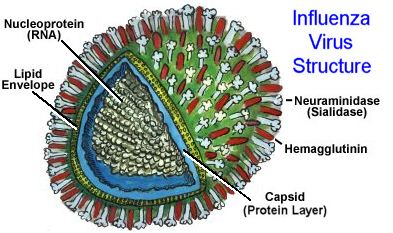
3. Disease caused by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dies without water

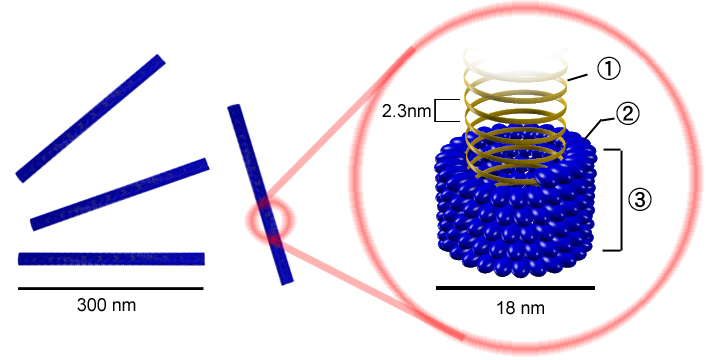
**Virus Structure**

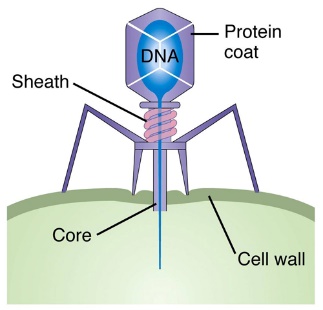
* All consist of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ called a (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

surrounding a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* **All are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Structure of viruses are highly variable but all have the same basic layout*



**How do viruses infect?**

* The virus lands on the cell then pierces its cell wall with its tail and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The now empty virus coat is useless - like an empty egg shell

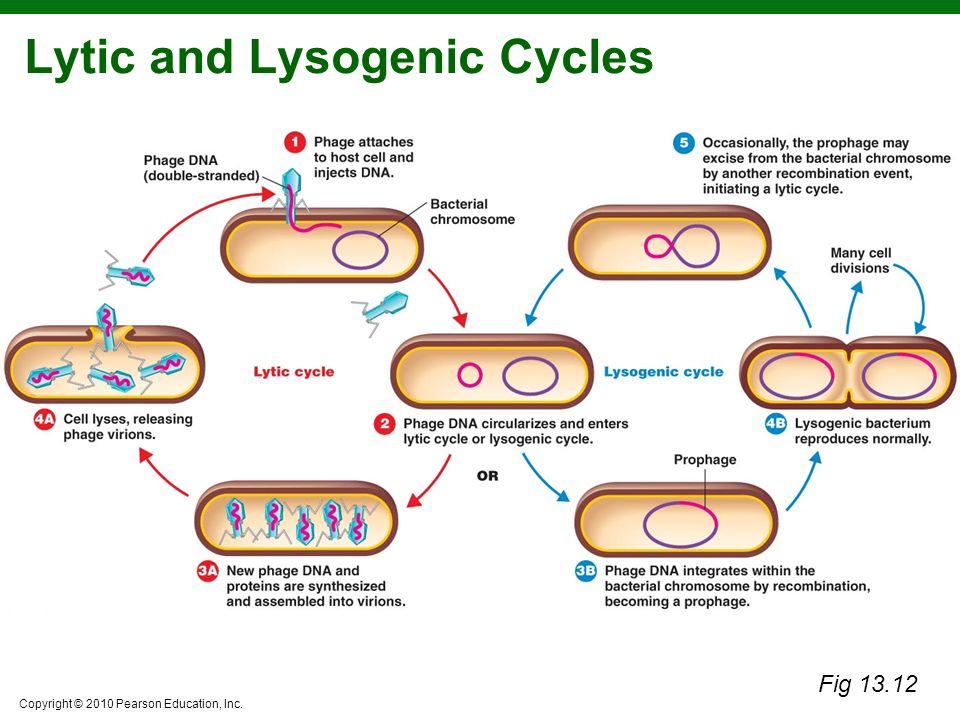
**"Life" Cycles:**

1. **The\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**This results in the death of the host cell by **\_\_\_\_\_\_\_\_** (to burst) as the virus uses the host cell to make copies of itself

2. **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** This results in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

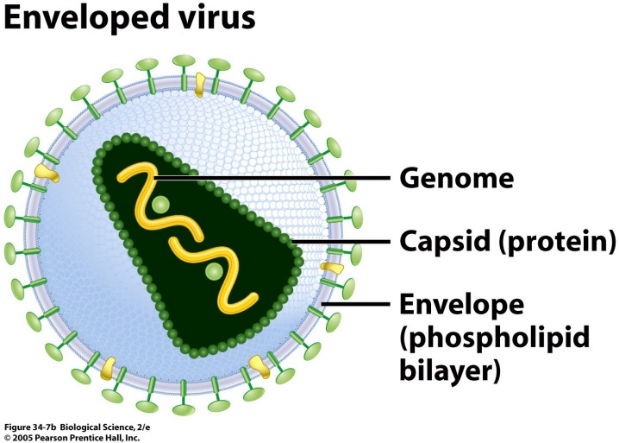
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*- The new genes are called a* ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** *(****provirus*** *if inserted into a human****)***



**Viral Diversity**

* Viruses can use either \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as their genetic material
* Two examples of viral diversity are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**Enveloped Viruses**

Some viruses have an outer membrane (captured from past host)

called a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

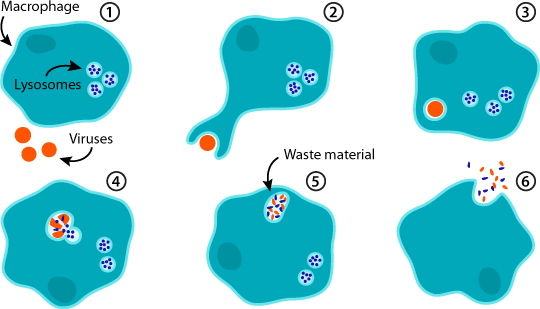
Helps them enter host cell by fusing envelope to cell membrane

– acts like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Ex: HIV, chickenpox)

**Retro Viruses**

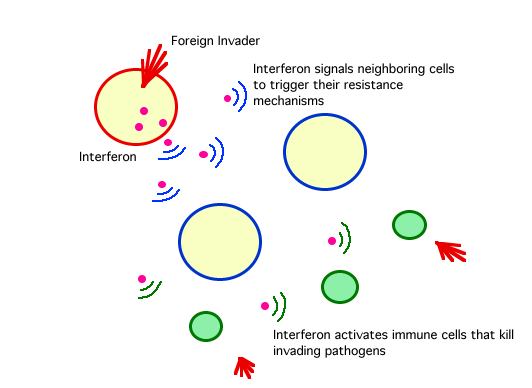
RNA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Ex: HIV)

\_\_\_\_\_\_\_\_\_\_ quickly due to being \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Responses to Viral Infections**

**1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

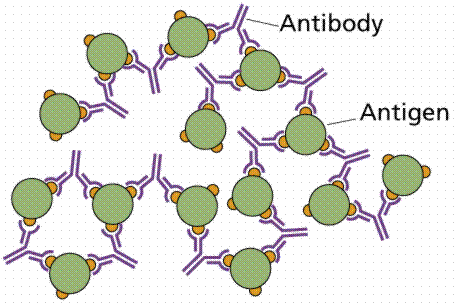
* The host’s white blood cells can “\_\_\_\_\_” the virus particle by engulfing and destroying it with enzymes in their lysosomes.



**2. Immune System Response**

**A. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:**

* A protein made by an infected host cell before it dies
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to defend against the virus
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to kill virus



**B. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:**

* Highly specific proteins made by white blood cells
* Attach to virus, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (deactivating them) and making them easy to be destroyed by other WBC.

**Can You …**

**… classify viruses as living or non-living?**

**… describe the structure of a virus?**

**… explain how a virus infects a host?**

**… compare and contrast the lytic and lysogenic cycles of viral reproduction?**

**… describe different types of viruses?**

**… explain human responses to viral infections?**