Viruses

Alive??

What does it mean to be ALIVE?

Those characteristics are:

- cellular organization
- Reproduction
- Metabolism
- Homeostasis
- response to stimuli
- growth and development
- Heredity - adaptation through evolution

Virus

- A virus is something that may contain DNA or RNA but it is so small that it exists between the living and non-living worlds.
- In fact a virus is a particle that does not perform any metabolic functions and relies solely on the host it invades for its metabolic functions.
- They are also very small, usually between 20 nm and 400 nm
- Viruses also have a reputation of causing everything from mild to severe illnesses, including death.
- Some viruses have been known to infect cells in such a way that they become cancerous.

Virus

- If we consider a virus to be a living thing, then it is the simplest organism that we will ever encounter...
- It is made up of an inner core that contains either DNA or RNA and an outer protective protein coat called a capsid.
- The capsid protects the virus from the environment and can even allow viruses such as the cold causing rhinovirus to live for hours in dry mucus.

Virus

- Since viruses do not perform any of their own metabolic functions, they must infect a host cell and use the host to perform its metabolic functions.
- Most important of these is reproduction.
- When viruses infect the host cell, they can take control of the reproductive mechanisms of the cell and have the cell reproduce the viral genetic material and the protein for the capsid.
- The newly formed virus particles will then leave the host cell, usually causing the death of the cell, and the particles can then go on to infect other cells.

Antibiotic use?

- Antibiotics that are useful for destroying bacteria that cause illness do not fight viral infections... you should already know about how antibiotics work!!
- Doctors currently can do very little for anyone infected with a virus, but they are working on it... we have several vaccines for Covid-19 and potentially a way to minimize symptoms and stop spread
- Since we do not have any medicines that will destroy a virus and stop the spread of the infection, we must suffer through the illness and do what we can to relieve some of the symptoms.

Viral Reproduction

Lysogenic Cycle

- Viruses have two mechanisms for reproduction.
- Viruses that cause cold sores, such as the herpes simplex virus, use a lysogenic cycle to reproduce.
- Once infected you will usually have the virus for your entire life.
- It will go into hiding in your cells and it is only when you experience some sort of stress to your system that the virus will emerge.
- That stress could be poor diet or having a cold that weakens your immune system.
- This stress allows the herpes simplex virus to come out of hiding and cause the cold sore.

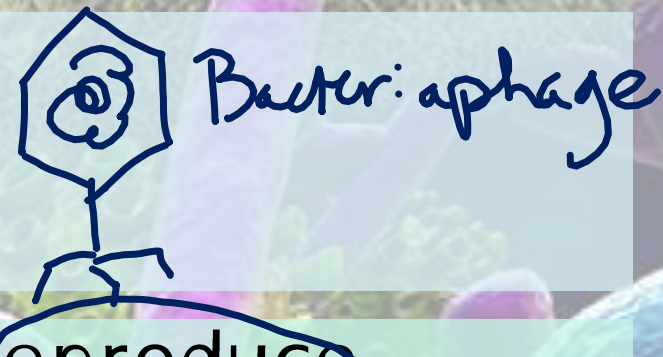
Lysogenic Cycle

- A virus reproducing using a lysogenic cycle will reproduce in the following manner:
- 1. The virus attacks the host cell and inserts its genetic material into the cell.
- 2. The genetic material is incorporated into the genetic material of the cell.
- 3. As the cell normally reproduces it also reproduces the viral genetic material.

Lysogenic Cycle

- Over time a large number of host cells will be infected with the dormant viral genetic material.
- Some sort of stimulus, such as environmental factors or stress on the host organism will cause the virus to activate.
- The activated virus will then take control of the cell and the host organism will experience symptoms of infection.

Lytic Cycle



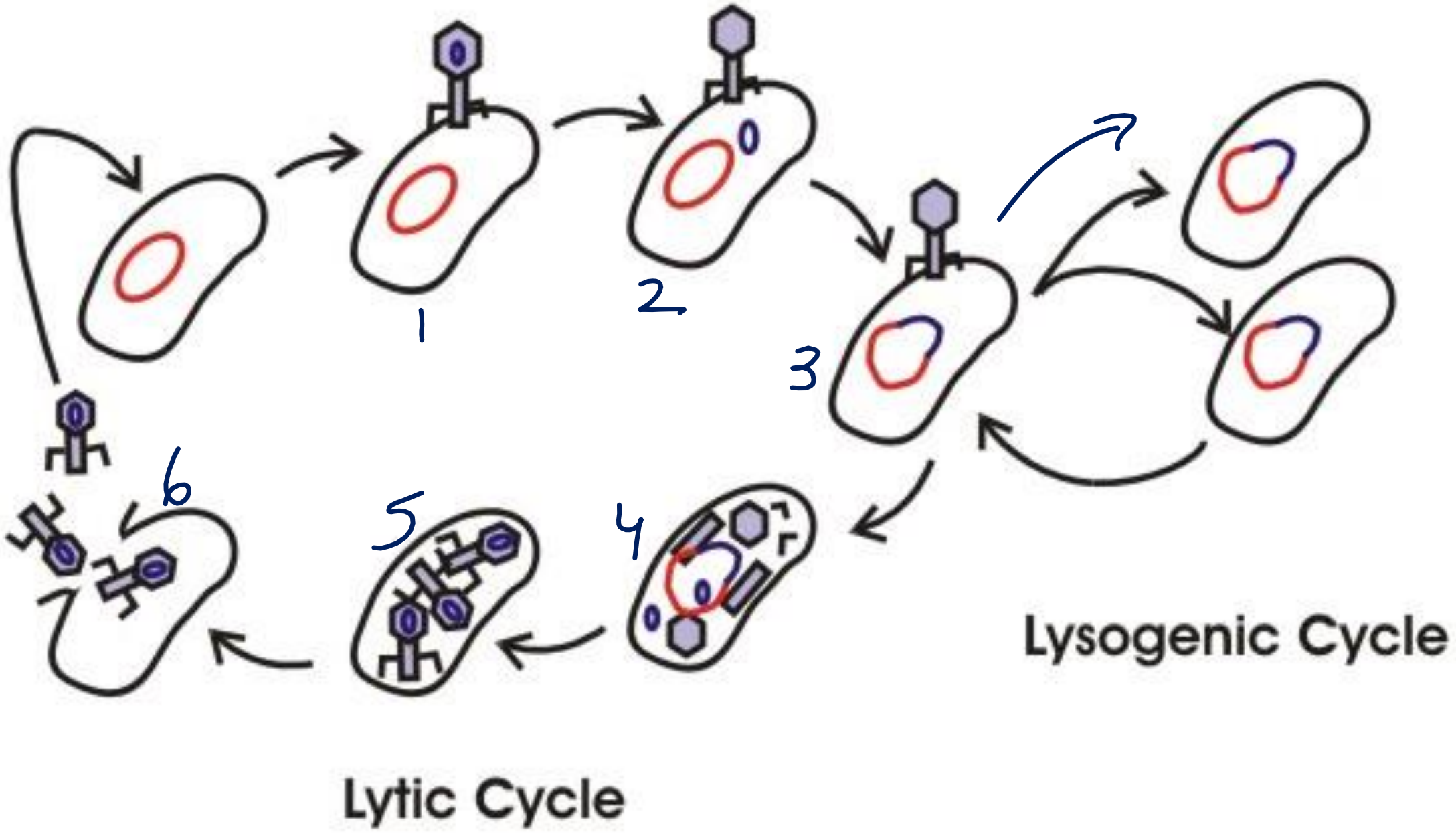
- Viruses can also use a lytic cycle to reproduce.
- The lytic cycle allows the virus to reproduce very quickly.
- The entire process can take as little as 30 minutes before the cell ruptures to release viral particles.

Lytic Cycle

- The most studied is probably the bacteriophage.
- A bacteriophage is a virus that only attacks bacteria (that is its host organism.
- This virus injects its DNA into a bacterium and then uses the bacteria to manufacture more viruses.
- The newly formed viruses rupture from the bacteria and are able to infect more bacteria.

Lytic Cycle

1. Once the virus encounters a host cell it transfers its genetic material into the host cell.
2. The genetic material in the virus instructs the host cell to manufacture the components of the virus, such as genetic material and capsid proteins.
3. The viral components are assembled into new viruses.
4. The newly formed virus particles rupture through the cell membrane of the host cell and the host cell dies as the virus is released.


1
2
3
4
5
6
Lysogenic Cycle
Lytic Cycle

Viruses and Health

- Not all viruses in nature can use us as a host organism.
- Viruses can only infect a specific host range.
- A host range is a specific species, tissue, or cell type that a virus can infect.
- For example the common cold virus only infects cells of the human upper respiratory tract where avian flu can infect and cause influenza in both birds and humans.

Viruses and Health

- When a virus infects you, your body does a very good job of fighting it off.
- Your immune system can recognize the virus and will eventually destroy it... of course you will feel sick for a little while.
- This is true for the common cold, but some viruses that use the lysogenic process may hide from your immune system by hiding inside your cells and you may have them for your entire lifetime.

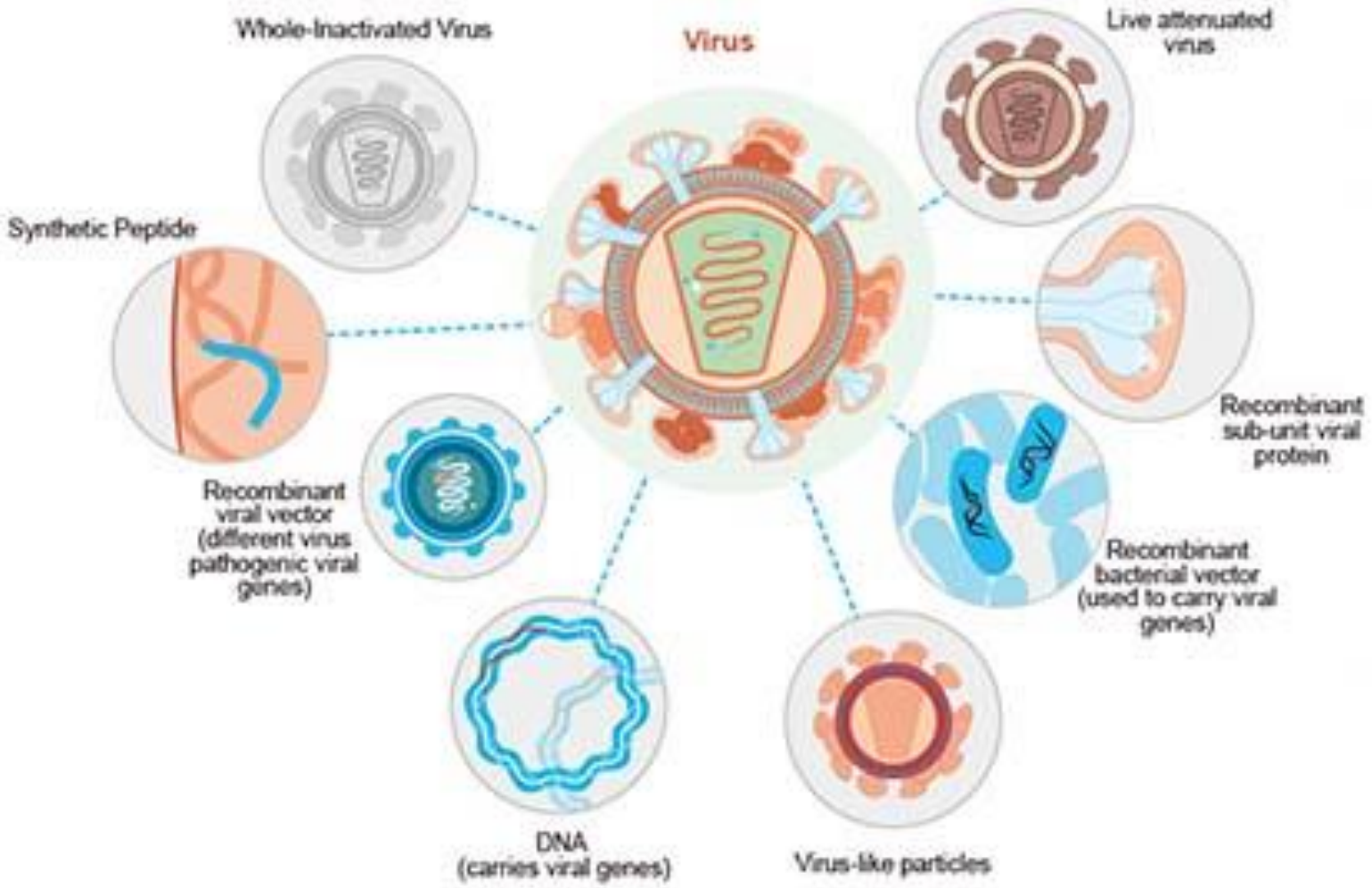
Immune Response

- Your immune system is very efficient at fighting some viruses.
- If a virus infects you, your body will start to produce antibodies that will attach to the virus and flag them for your white blood cells to attack and destroy.
- Your body does not produce these antibodies until the virus has infected you.
- In an effort to prevent people from getting infected even once, medical advances have developed vaccines that will give you the antibodies needed to prevent the virus from infecting you.

Immune Response

- The most common types of vaccine use weakened or dead viruses that are injected into you.
- The virus is not strong enough to cause the illness but will trigger your immune system to produce the antibodies that will allow your immune system to destroy the virus.
- You will typically carry these antibodies for your lifetime. That is why some viruses, like the one that causes chicken pox (varicella-zoster), can only infect you once in a lifetime.

Types of Vaccines



Live attenuated (LAV)

- Tuberculosis (BCG)
- Oral polio vaccine (OPV)
- Measles
- Rotavirus
- Yellow fever

Inactivated (killed antigen)

- Whole-cell pertussis (wP)
- Inactivated polio virus (IPV)

Subunit (purified antigen)

- Acellular pertussis (aP).
- *Haemophilius influenzae* type B (Hib).
- Pneumococcal (PCV-7, PCV-10, PCV-13)
- Hepatitis B (HepB)

Toxoid (inactivated toxins)

- Tetanus toxoid (TT).
- Diphteria toxoid

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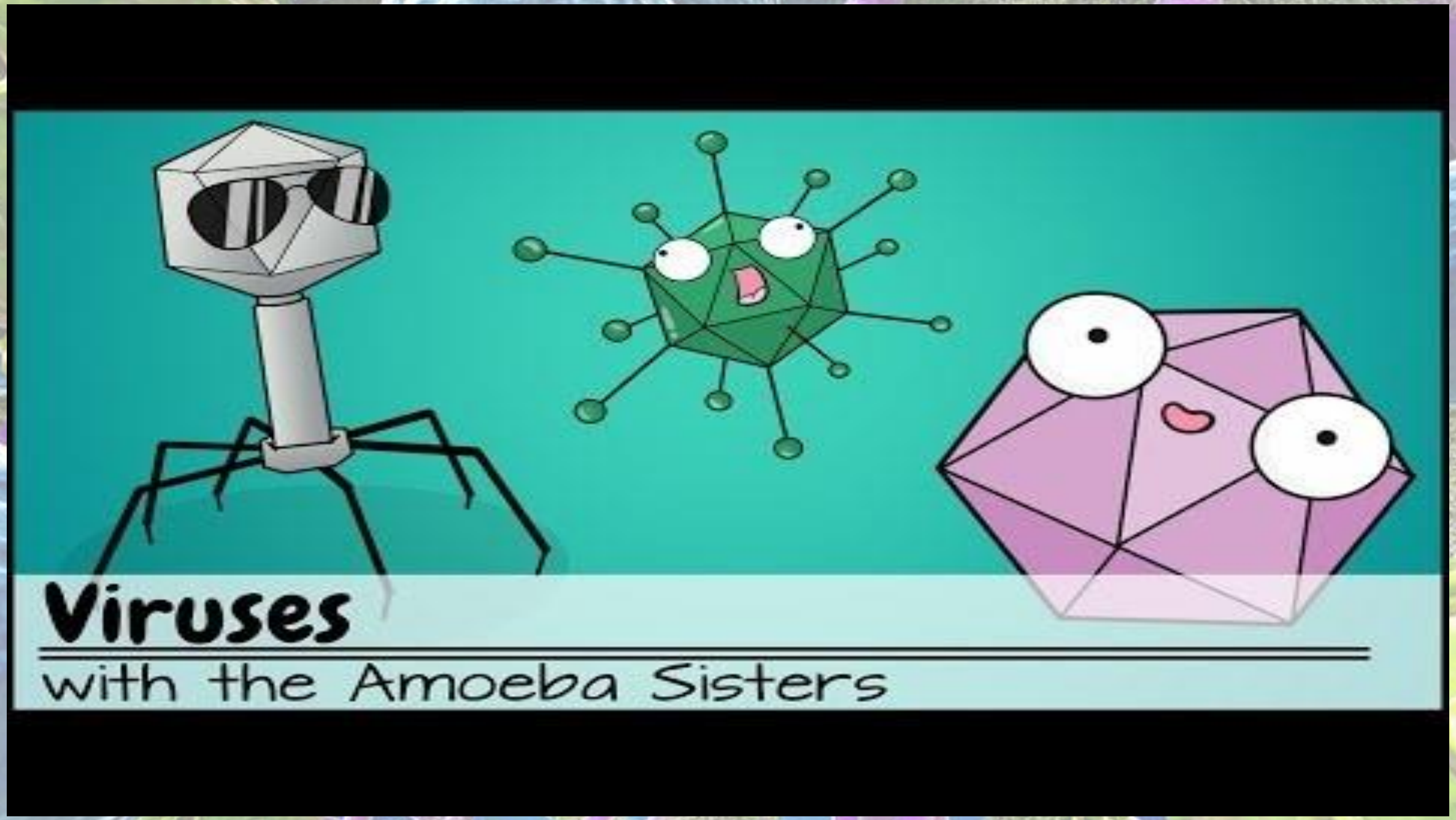
Task

- Watch the Amoeba Sisters – Viruses (do the worksheet instead of you taking notes (not for submission)
- Complete the comparison chart of Bacteria and Viruses (submitted in Teams)
  - Use your notes and where you need to please do research!! Keep track of the pages you use


Viruses
with the Amoeba Sisters