

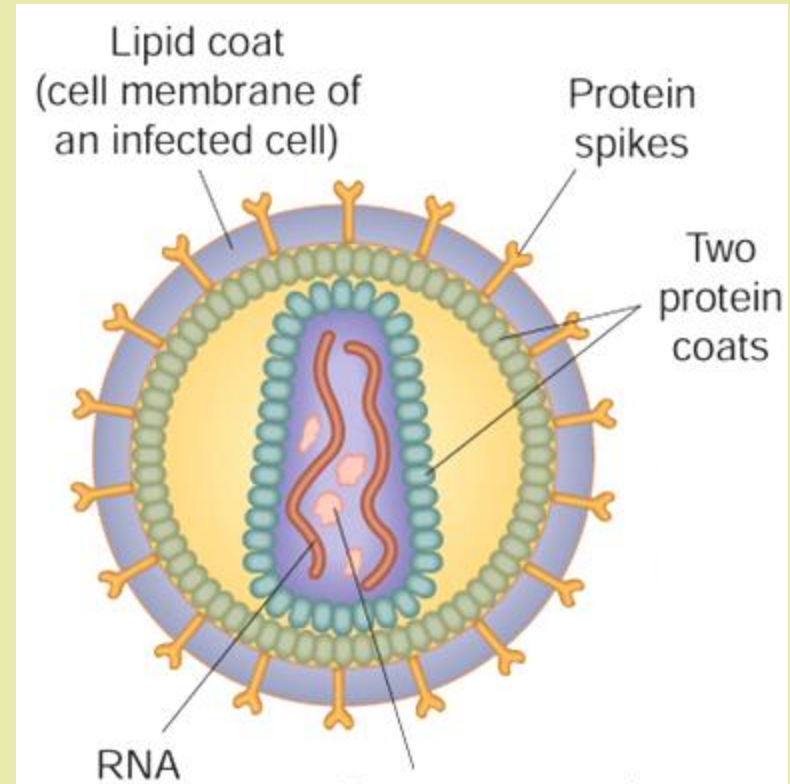
### 3.5.4 VIRUSES

Objectives – What you will need to know from this section

- Identify the problem of definition - living or non-living?
- State that there is a variety of shapes.
- Outline the basic structure of viruses.
- Explain the process of viral replication -- only within living cells-- therefore can be called obligate parasites
- Economic and medical importance of viruses to humans, plants, animals:  
Include 2 harmful, 1 beneficial example of viruses.

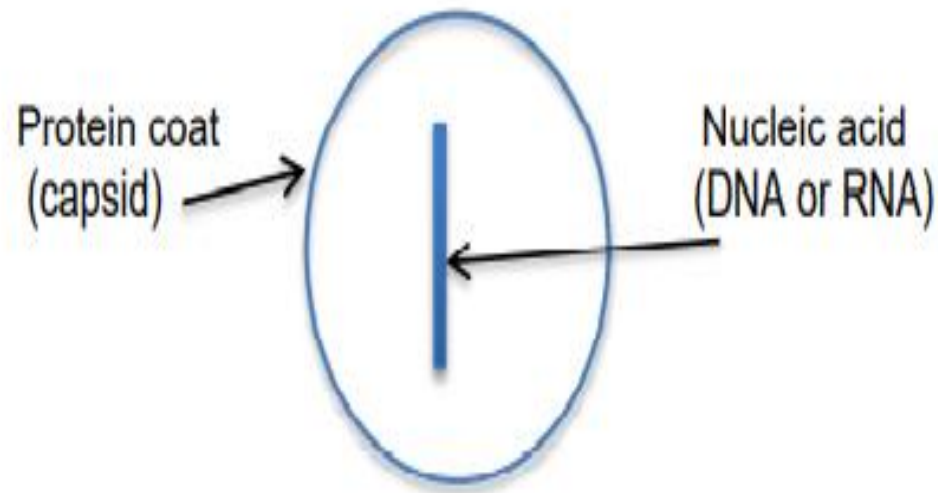
# VIRUSES

- Viruses are infectious agents made up of nucleic acid (DNA or RNA) surrounded by a protein coat.
- Because they are **not** made of cells, they do not have the cell machinery for their own metabolism, and so they only grow in **living tissue**.



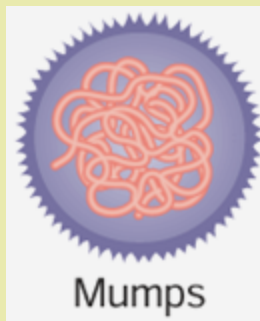
- Where they exist outside living cells, they may be considered **non-living** chemicals, since they do display any of the characteristics of life.

## Virus structure



- Have an outer **protein coat called a capsid**
- Inside capsid is a **nucleic acid (DNA or RNA)**

- Once inside a living cell, they can **replicate** with the help of the host cell and so are clearly **alive**.
- So, viruses have features of **both** living and non-living material.
- Since they can only multiply inside living cells, they are called **obligate parasites**
- As parasites they cause many **diseases** in humans, domestic animals and crop plants.



Tobacco mosaic

- **Parasite**- Organisms that live in or on another organism causing it harm
- **Obligate Parasite**= has to be a parasite (has to have a host) ex virus
- **Facultative**- does not have to be a parasite ( have a host) ex candida
- **Pathogenic**= disease causing

- Since they can only multiply inside living cells, they are called **obligate parasites**

- This means that they **cannot** be grown on agar like bacteria or fungi.



- It is also the reason why antibiotics do **not** work against them, as there is no cell machinery for the antibiotic to damage.



## Are viruses living or dead?

### Living and Non living features

<u>Reasons for classifying as living</u>	<u>Reasons for classifying as Non living</u>
Possess genetic material (DNA or RNA)	Are Non cellular
Can replicate	Cannot reproduce by themselves
Have a protein coat	Only have DNA or RNA (not both)
	Do not have mitochondria or chloroplasts

# VIRUSES

1  $\mu\text{m}$  (1/1000 mm)



Cowpox



Rabies



Mumps



Bacteriophage



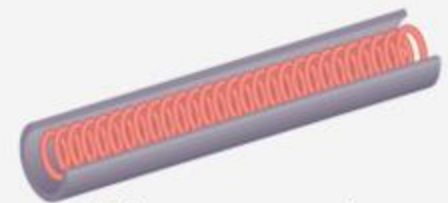
Herpes  
(cold sores)



Influenza



Polio



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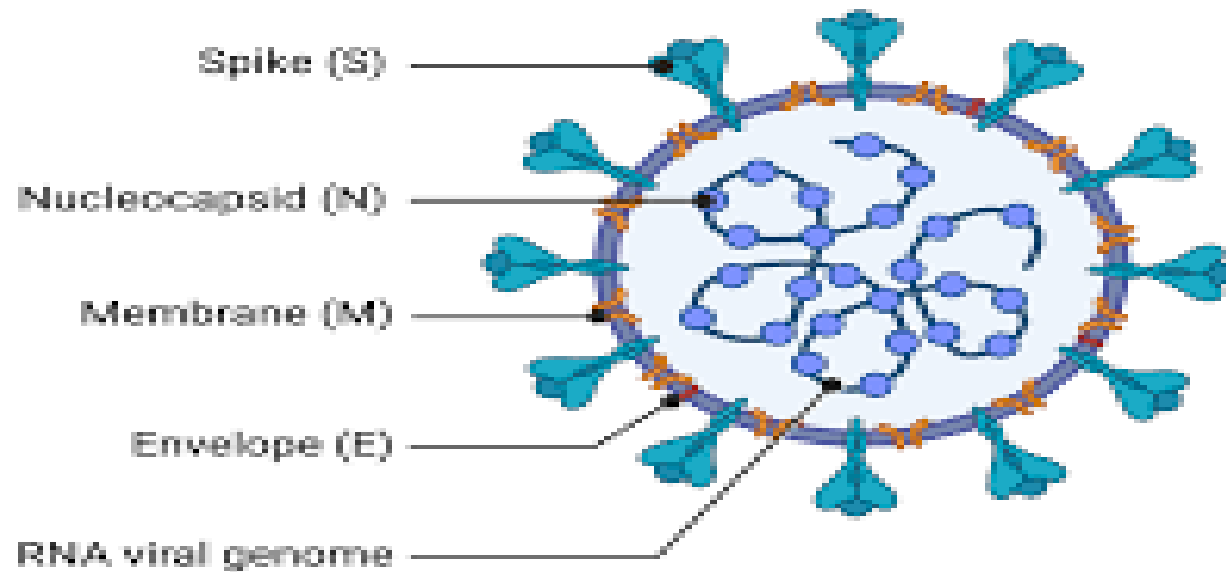
- Different kinds of viruses have different **shapes** and this is one way of recognising and classifying them.
- Because viruses are so small, we can only see them with an **electron microscope**.
- 10,000 viruses could fit side by side on the **tip** of your pen.

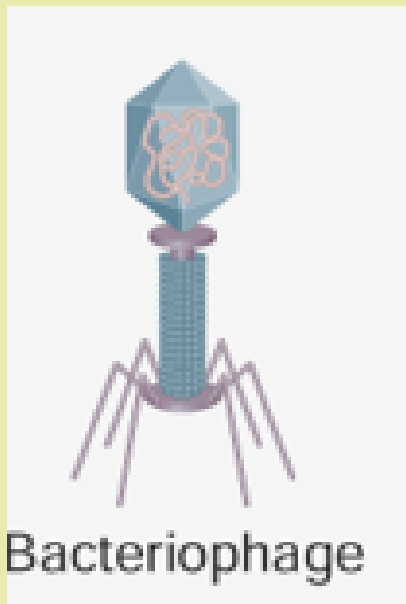


# Main Virus Shapes

- 1) Round
- 2) Rod shaped
- 3) Complex in shape

# Coronavirus Structure





**Bacteriophages are complex viruses that infect bacteria but are harmless to humans**

**Friendly Viruses**

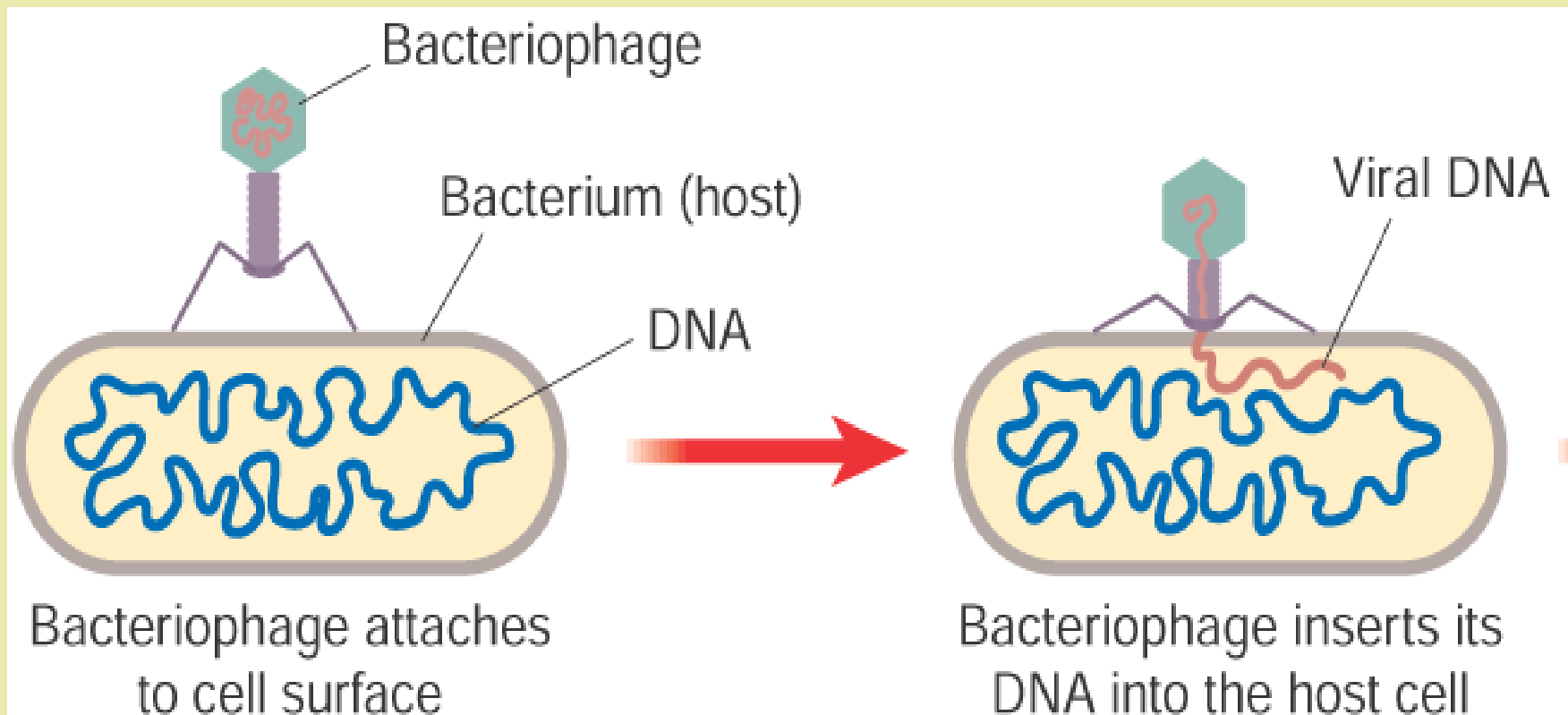
**Can kill MRSA bacteria (Superbug)**

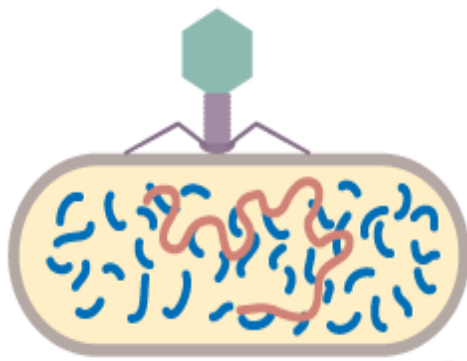
# LEARNING CHECK

- What is a nucleic acid?
- What is a virus?
- What does obligate parasite mean?
- How are virus generally identified?
- Are virus living or non-living?
- Name 5 common viruses.
- Why can we not grow viruses on nutrient agar, like bacteria?
- Why do antibiotics not kill viruses?

## Viral Replication

- A **virus** is an infectious agent that consists of nucleic acid (DNA or RNA) enclosed in a protein coat.
- The virus attaches to a host cell, and inserts its nucleic acid into the cell's cytoplasm.





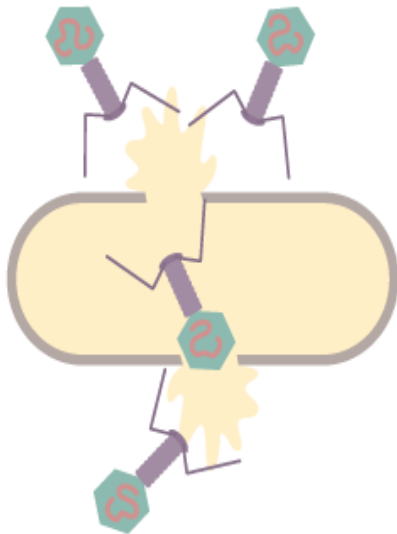
Viral enzymes destroy the bacterial DNA

- The viral nucleic acid takes over the cell's own DNA

- and makes many copies of itself.



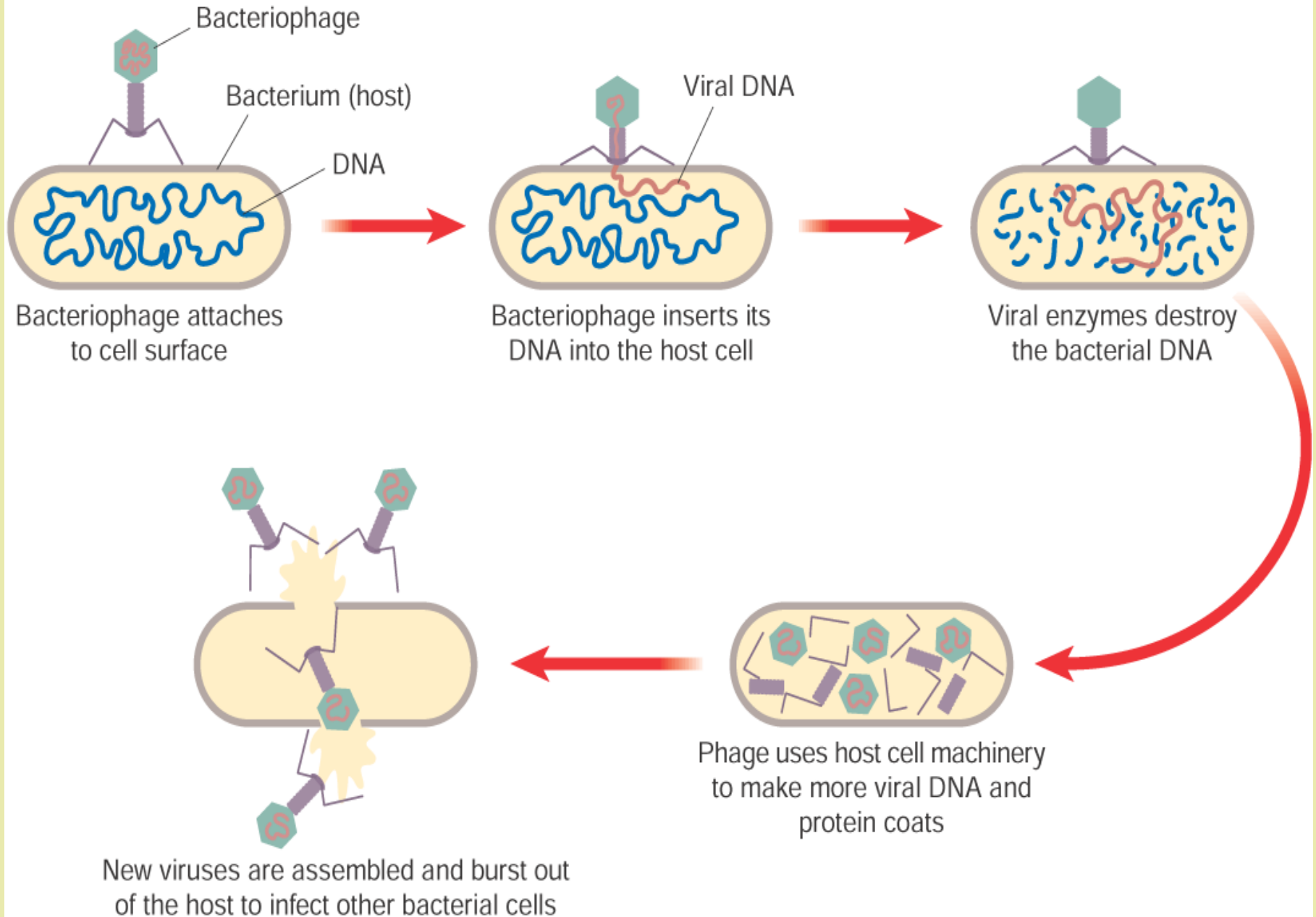
Phage uses host cell machinery to make more viral DNA and protein coats

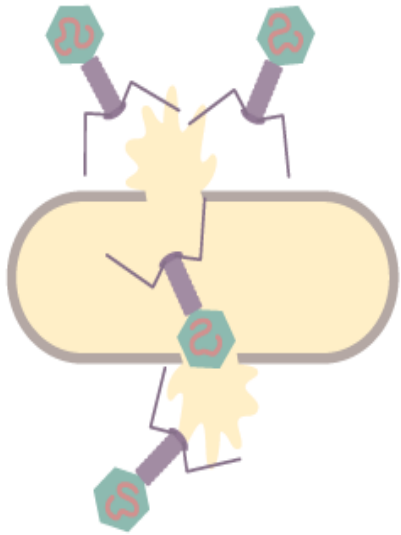


New viruses are assembled and burst out of the host to infect other bacterial cells

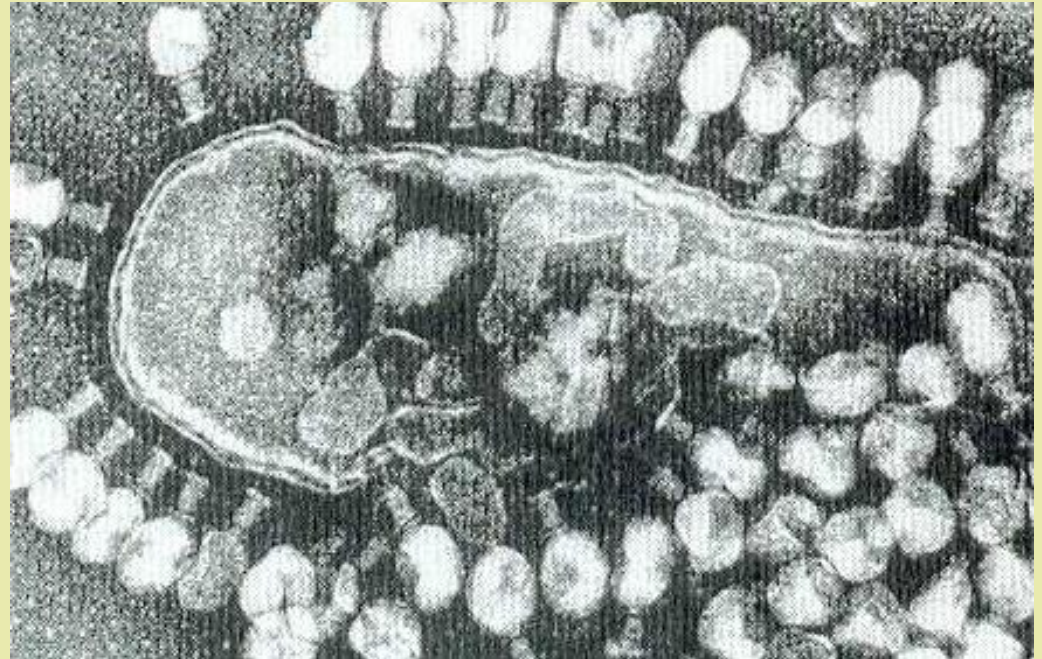
- The new viruses burst out of the host cell to infect further cells.

# VIRUS REPLICATION -- Summary





New viruses are assembled and burst out of the host to infect other bacterial cells

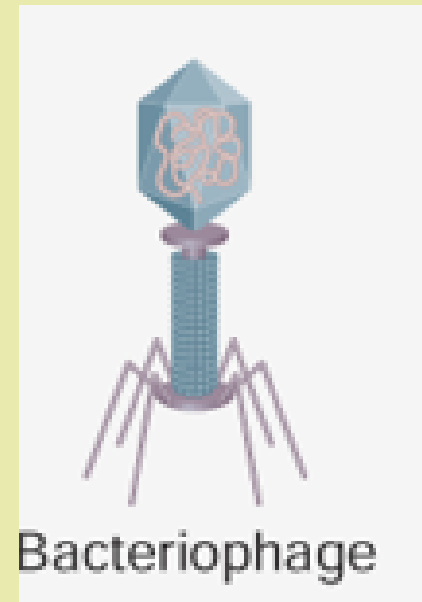
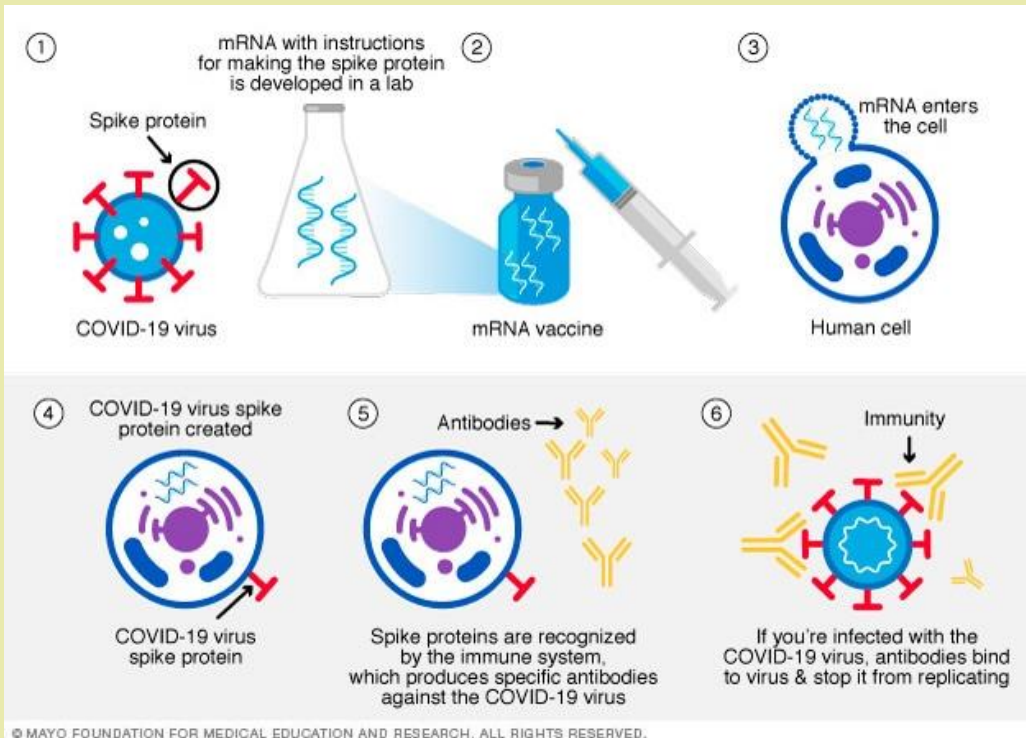




# Advantages of Viruses

➤ Genetic Engineering,  
**Covid 19 Vaccine** –  
genetically modified  
virus

➤ **Bacteriophages**  
–possible solution  
to killing bacteria  
that are resistant to  
antibiotics



# Disadvantages of Viruses

## Diseases of Humans, Plants and Animal

➤ Human Diseases—common diseases, such as:



Measles



Mumps



Rubella



Cold



Warts

## Plant Diseases

- gain entry via a vector (carrier) such as insects
- cause mosaic disease (striped patterns) in major crop plants.



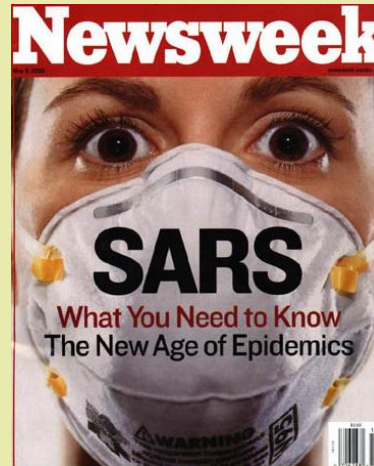
Tobacco

# Animal Diseases, such as :

## Foot and mouth



## SARS\*



## Rabies



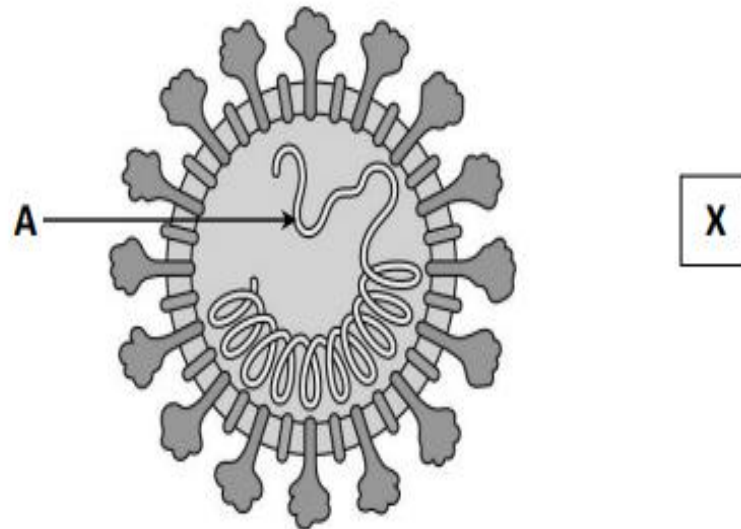
\*Sudden Acute Respiratory Syndrome

# LEARNING CHECK

- What does replication mean?
- What is a bacteriophage?
- Distinguish between a parasite and a host.
- Give 3 disadvantages of viruses.
- Give 2 advantages of viruses.
- Explain the term vector as applied to diseases.

# 2022 Q 7

7. The diagram below shows the structure of a typical virus, such as SARS-CoV-2 (a type of coronavirus). It is one example of a harmful virus and it causes COVID-19 in humans.



- (a) Name molecule **A**.

- (b) Antigens are present in viruses. **On the diagram above**, draw an arrow from 'X' to accurately show the location of an antigen.

(c) Explain why viruses are described as obligate parasites.


(d) Vaccination has proved to be very effective in combatting COVID-19.  
Explain in detail the term *vaccination*.


(e) Name **one** harmful virus, other than SARS-CoV-2 (coronavirus).

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(f) Give **one** example of a beneficial application of a virus.




2020 Q15b I-iv