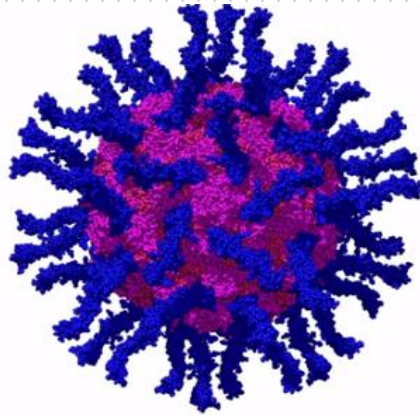


Introduction to Medical Virology



Dr. Shuaibu Abdullahi Hudu, MBBS (Nig), PhD (Malaysia)

Faculty of Dentistry,
Zarqa University, Jordan

Intended Learning Outcomes

- Define Virus
- Understand how virus was discovered
- Describe the General Properties and structure of viruses
- Know how viruses were named
- Described how viruses are classified
- Outline viral symmetry

What is Virus?

An Infectious, **Obligate Intracellular**
Parasite Comprising of **Genetic**
Materials (DNA or RNA), often
Surrounded by **Protein Coat**, and
Sometimes a **Membrane**

What is Virion?

is the complete infectious virus particle

VI

Evolving of viruses

- ❖ The word 'virus' is Latin, meaning 'Poison'
- ❖ Virus was describe as:
 - Small Bacterium

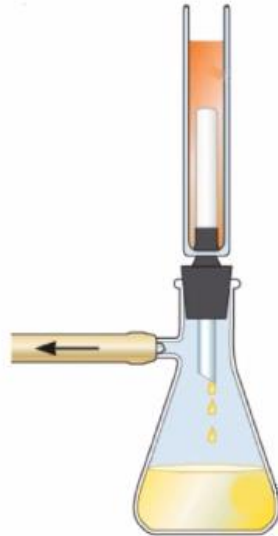
tightly partial it only allow
water an order filter to go in
to doesn't allow bacteria to
pass through

Small Bacterium

- Developed a porcelain filter to remove bacteria from drinking water
- Pasteur found that rabies agent passed through it, thought it was a small bacterium



Louis Pasteur



**Charles Edouard
Chamberland(1884)
Louis Pasteur
assistant**

The following properties distinguish viruses from other microorganisms:

- 1- They are very small in size, only seen by electron microscopy (EM).
- 2- They contain one kind of nucleic acid (RNA or DNA) as their genome. gentic material
- 3- They are metabolically inert, as they do not possess ribosomes or protein synthesizing apparatus. ribosome
بالتالي ما بقدر يصنع
protien
- 4- They are obligate intracellular parasites i.e. can only replicate inside living cells.
- 5- Hence, they cannot be grown on artificial culture media and are grown in tissue culture or living animals. ✓
- 6- They are not susceptible to antibacterial antibiotics.

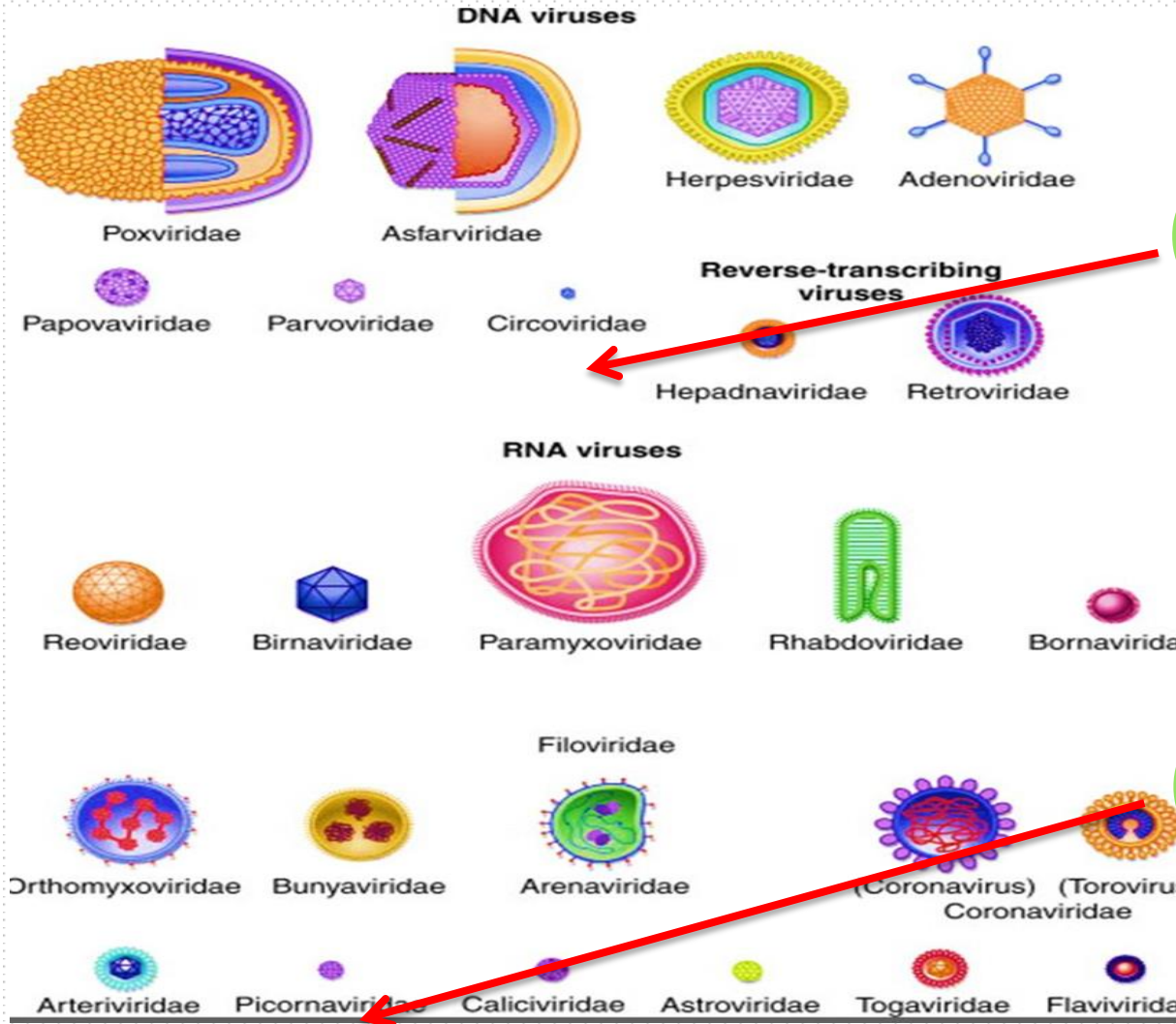
General Properties of viruses

VIRUS SIZE

we have two group of virus;

1.DNAvirus content DNA
in genetic material
EX; Circoviridae

2.RNAvirus content RNA in
genetic material
EX; Picornaviridae



the smallest size of DNA

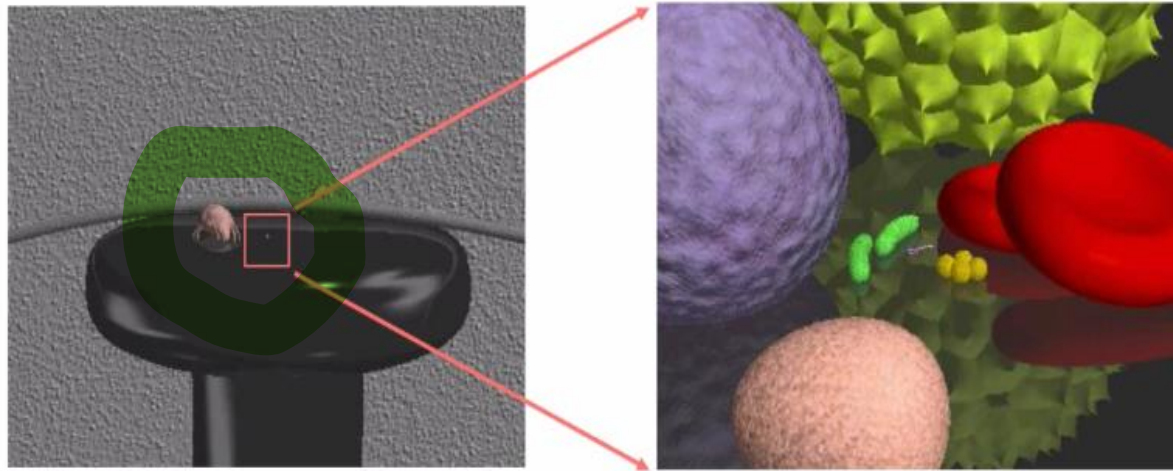
Circoviridae is 17-nm

the smallest size of RNA

Picornaviridae (22 to 30 nm)

VIRUS SIZE

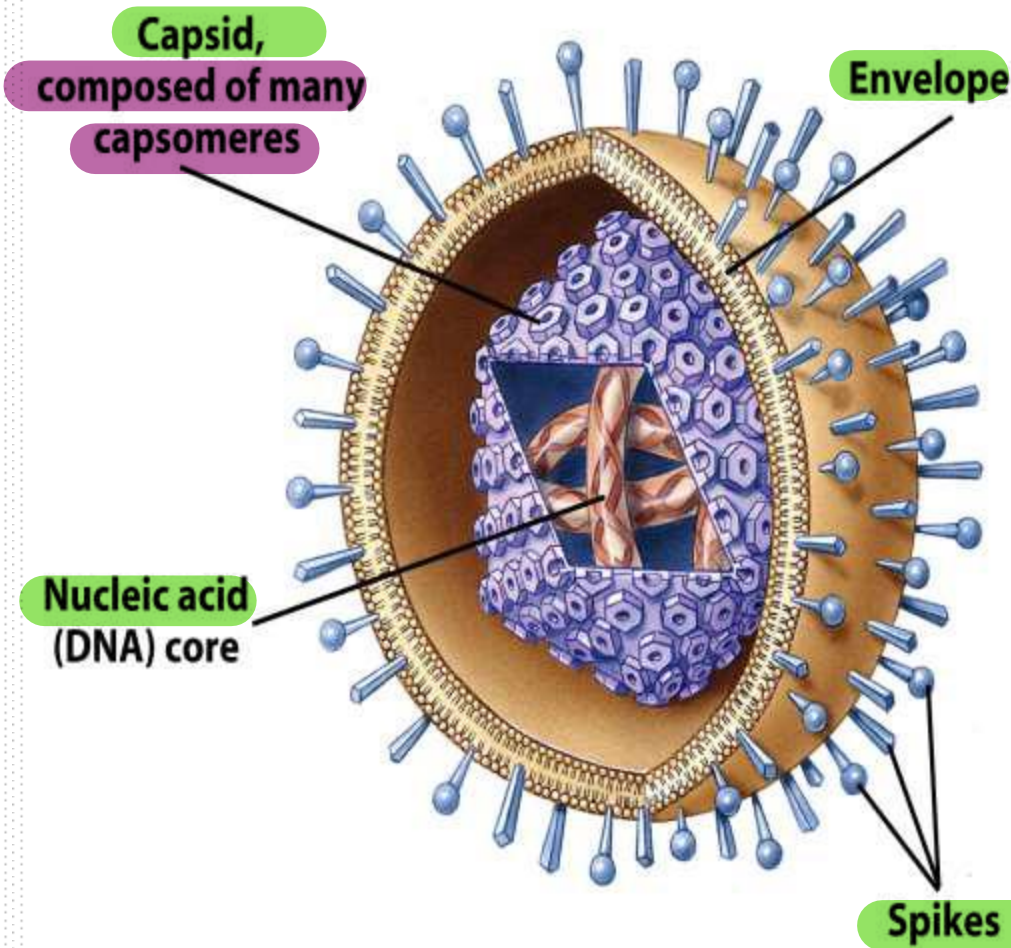
How many viruses can fit on the head of a pin?



2 mm = 2000 microns

- 500 million rhinoviruses A small virus causes common cold, sore throat, nasal congestion and runny nose can easily be taken by air
- When you sneeze, you fire an aerosol that contains enough viruses to infect thousands

Viral Structure



viral components very important in metabolism

Viral Components

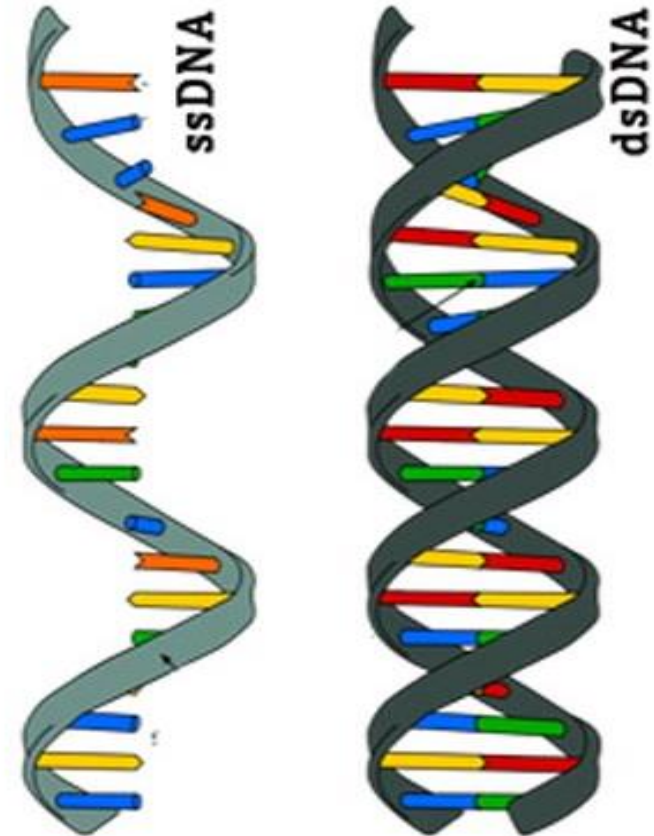
- ✓ Nucleic acids
- ✓ Capsid
- ✓ Envelope
- ✓ Enzymes

ribosome
حسين هيك ما عنده القدرة يصنع
protein

Virus Genome

- ❑ RNA or DNA, but not both
- ❑ DNA: Single stranded OR double stranded
- ❑ RNA: Segmented OR non-segmented

DNA; بصفة حسب Strand
RNA; بصفة حسب Segment



DNAvirus;
capsid covering
لما يحتوي على
بسميه = nucleocapsid

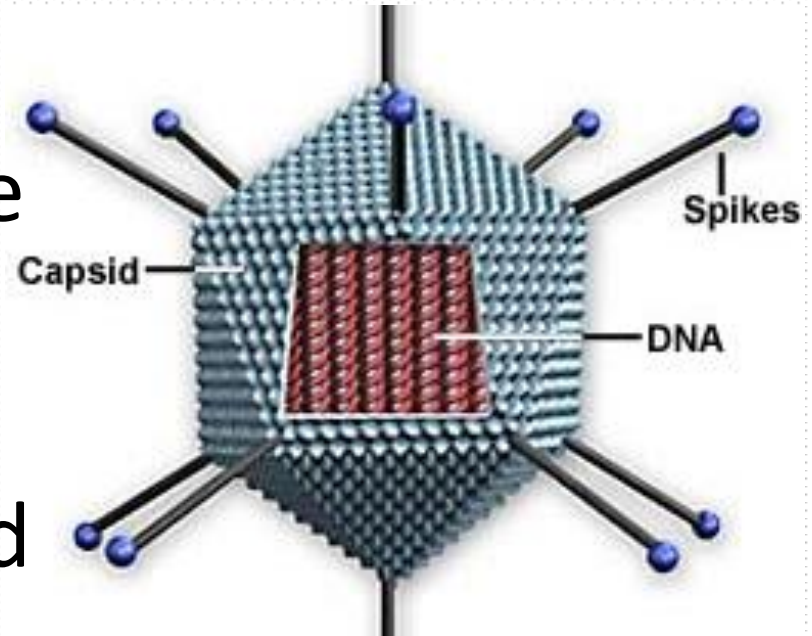
Viral Capsid

capsid; cover virus

nucleocapsid= genetic material and capsid

- ❖ **Capsid** is the protein shell that encloses the **nucleic acid** to form **nucleocapsid**
- ❖ The shell is composed of protein organized in subunits known as **capsomers**

unit just like sugar bind together to form capsule



Viral Capsid

Has three functions:

- ❖ It protects the nucleic acid from digestion by enzymes
- ❖ Contains special sites on its surface that allow the virion to attach to a host cell
- ❖ Provides proteins that enable the virion to penetrate the host cell membrane and to inject the nucleic acid into the cell's cytoplasm

موجود بالفيروس ويعطيه القدرة انه يدخل الخلية عشان يتضاعف جواتها; Glycoprotein

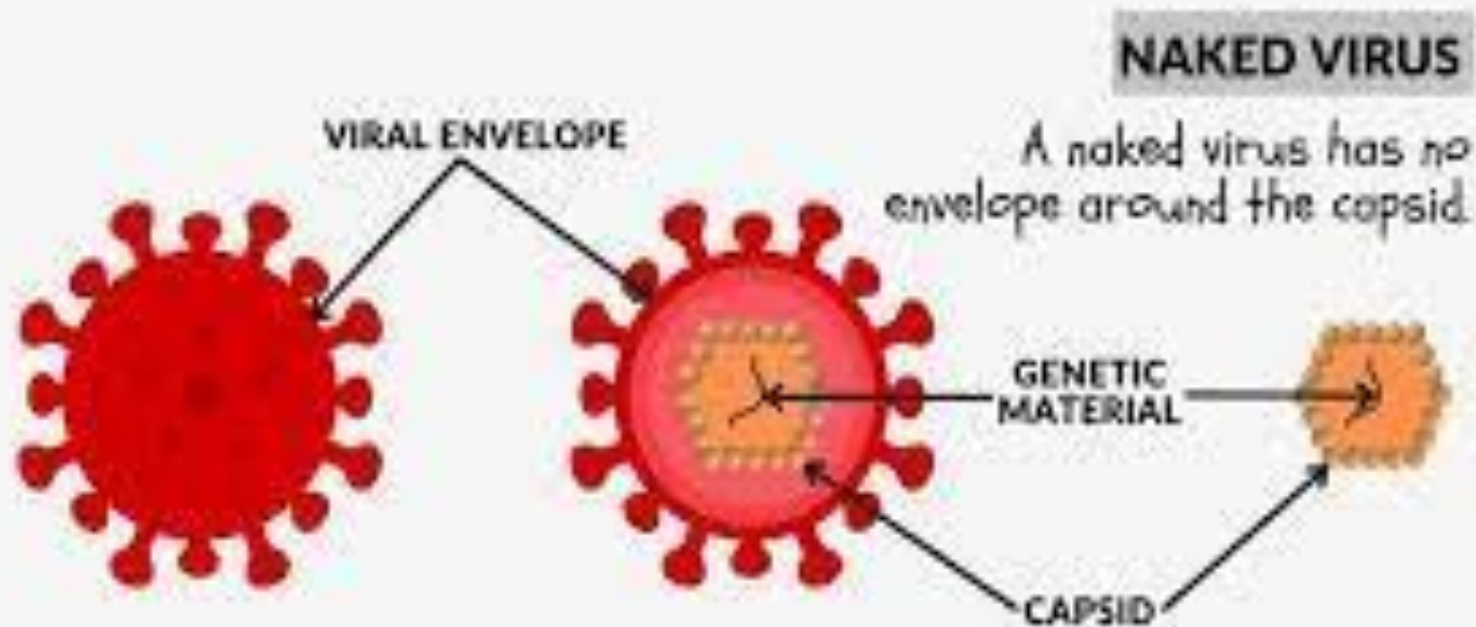
Viral Envelope

some viruses have additional layer which called envelop

مش كل الفيروس عندها
envelop

- ❑ The envelope is composed of **two lipid layers** interspersed with protein molecules (**lipoprotein bilayer**) to process replication
- ❑ May contain **material** from the **membrane of a host cell** as well as that **of viral origin**
- ❑ Many viruses also develop **spikes** made of **glycoprotein** on their envelopes that help them to **attach to specific cell surfaces**

Enveloped and non enveloped



ENVELOPED VIRUS

An enveloped virus has an additional layer (envelope) that surrounds the capsid.

nonenvelop;
DNA/RNA
enzyme
spikes
يسمى Naked virus

Envelop;
DNA/RNA
enzyme
spikes
Coat and capsule

ننتبه ع الاختلاف انه

envelop

two additional layer coat /capsle يحتوي على

Viral Enzymes

1

- Viral **proteases** are **essential** for processing virally encoded polyproteins during replication

Rt; this enzyme converts RNA to DNA and commonly found in one group of virus Retrovirus

2

- **Reverse transcriptase** copies the viral RNA genome into a single minus strand of DNA

3

- **Integrase** is the viral enzyme that **catalyzes** the integration of virally derived DNA into the host cell DNA in the nucleus

How are viruses named?

Based on:

□ the disease they cause

poliovirus, rabies virus

polio disease

rabies infection

□ the type of disease

murine leukemia virus, SARS

SARS; severe acute
respiratory syndrome

□ geographic locations

Lassa virus, Coxsackie virus

In Africa

In US

□ their discoverers

Epstein-Barr virus

كمان عنا الكورونا فايروس اخذنا
اسمه من حسب موقعه الجغرافي
لانه بدا من ووهان بالصين

Viral taxonomy

1. Taxonomic groups – family, subfamily, genus and species
2. The names of virus families (family) are italicized - End in Latin suffix – *viridae*
3. The genera (genus) end in the suffix – *virus*
4. The species – Common name

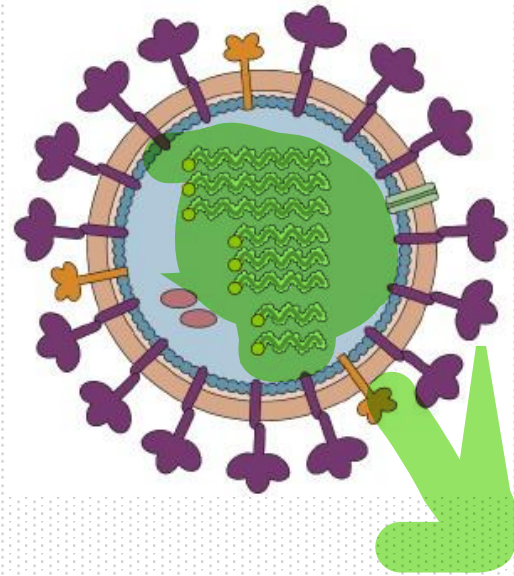
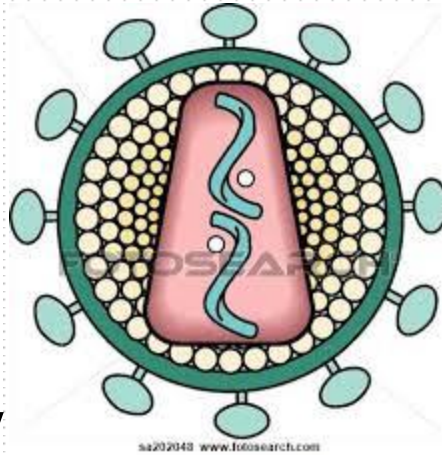
Table 10.1 Taxonomic groups of viruses

Taxonomic group	Suffix	Example 1	Example 2	Example 3
Family	- <i>viridae</i>	<i>Myoviridae</i>	<i>Paramyxoviridae</i>	<i>Coronaviridae</i>
Subfamily	- <i>virinae</i>	–	<i>Paramyxovirinae</i>	–
Genus	- <i>virus</i>	<i>T4-like viruses</i>	<i>Morbillivirus</i>	<i>Coronavirus</i>
Species	–	<i>Enterobacteria phage T4</i>	<i>Measles virus</i>	<i>Severe acute respiratory syndrome virus</i>

Viral Genome Classification

SS;Single Strand
ds;douple strand

- DNA / RNA
- ds/ss DNA
- ds/ss RNA
- Segmented/
None-segmented



the virus that have more than one genetic material inside called **segmented**

8 genetic material=segmented

Viral Genome Classification

all RNAvirus a single strand except
Reoviridae

RNA Viruses

RNA viruses (+ve sense)

- Picornaviridae
- Togaviridae
- Flaviviridae
- Retroviridae
- Coronaviridae

RNA viruses (-ve sense)

- Paramyxoviridae
- Rhabdoviridae
- Orthomyxoviridae
- Filoviridae
- Bunyaviridae
- **Reoviridae** (double-stranded)

Viral Genome Classification

DNA Viruses

all DNAvirus a Double strand
except Parvoridae

Double – stranded

- ❖ Adenoviridae
- ❖ Herpesviridae
- ❖ Poxviridae
- ❖ Papovaviridae
- ❖ Hepadnaviridae

Single – stranded

- ❖ Parvoridae

Viral Symmetry

The arrangement of the capsomers, in the capsid, gives the virus its geometric symmetry.

Viruses have 3 types of symmetry:

1- **Cubical symmetry**: These viruses resemble a crystal and are called icosahedral viruses e.g.

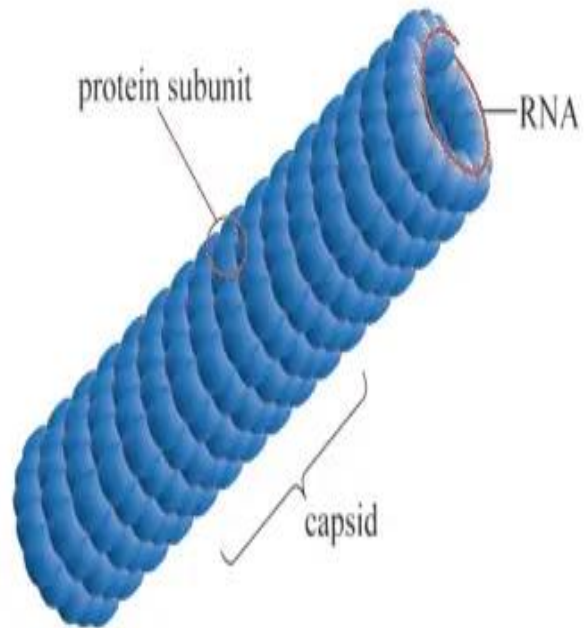
herpesviruses.

EX;adenovirus

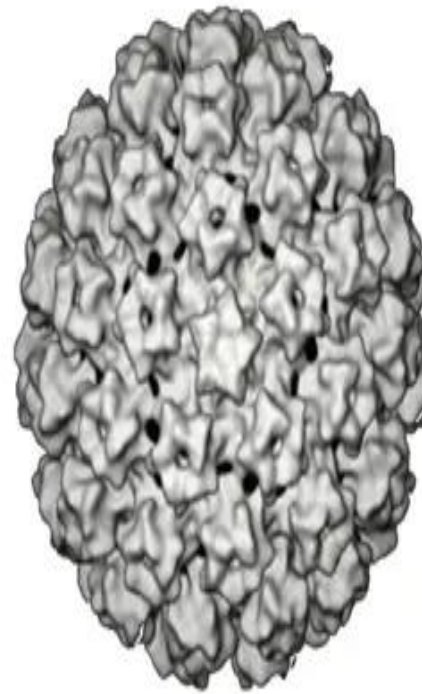
2- **Helical symmetry**: in which the particle is elongated. The capsomers are arranged in a ribbon which is wound in the form of a helix or spiral around the nucleic acid . e.g. influenza virus.

3- **Complex symmetry**: in which the viruses are complicated in structure e.g. The bacteriophage is example of complex symmetry.

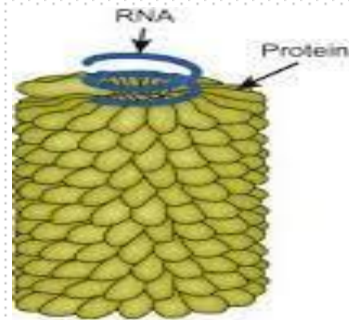
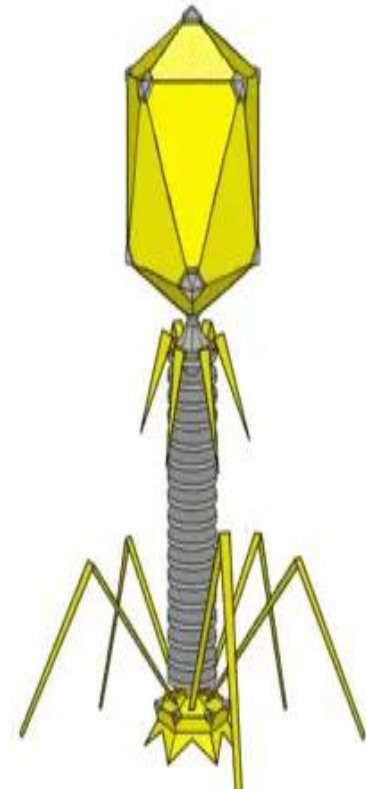
Helical



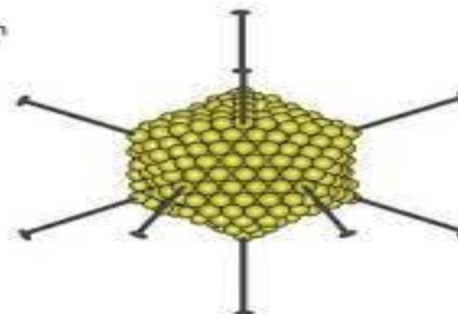
Icosahedral



Complex



HELICAL
(part of tobacco
mosaic virus)



ICOSAHDRAL
(adenovirus)



Thank You