Bacteriophage Classification

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Classification

- Although properties such as host range and immunologic relationships are used in classifying phages, the most important are phage morphology and nucleic acid properties.
- On the bases of electron microscopic studies Bradley (1967) described seven morphological types:

Type A	Hexagonal head, rigid tail with contractile sheath and tail fibers. Eg. dsDNA T even (T2, T4, T6) phage
Type B	Hexagonal head, lack contractile sheath, tail flexible, may or may not have tail fibers. Eg. dsDNA phage (T1, T5)
Type C	Hexagonal head, tail shorter than head. Tail lack contractile sheath, may or may not have tail fiber. Eg. dsDNA phage (T3, T7)
Type D	Head made up of capsomers, lack tail. Eg. ssDNA phage (ϕx174)
Type E	Head with small capsomers, no tail eg. ssRNA phages (F2, MS2)
Type F	Filamentous phage eg. ssDNA phages (Fd, F1)
Type G	Has a lipid containing envelop, has nodetectable capsid. Eg. dsRNA phage MV-L2

- International Committee for Taxonomy of Viruses (ICTV) classifies the bacteriophages under an order **Caudovirales** according to morphology and nucleic acid. ⟶

S.No.	Family	Morphology	Nucleic acid	Examples
1	Myoviridae	Non-enveloped, contractile tail	Linear dsDNA	T4
2	Siphoviridae	Non-enveloped, long non-contractile tail	Linear dsDNA	Phage λ
3	Podoviridae	Non-enveloped, short non-contractile tail	Linear dsDNA	Coliphage T2
4	Tectiviridae	Non-enveloped, isometric	Linear dsDNA	Phage PRD1
5	Corticoviridae	Non-enveloped, isometric	Circular dsDNA	PM2
6	Lipothrixviridae	Enveloped, rod shaped	Linear dsDNA	α-lipothrixviruses, β-lipothrixviruses
7	Plasmaviridae	Enveloped, pleomorphic	Circular dsDNA	Acholeplasma phage, Sma phage
8	Rudiviridae	Non-enveloped, rod shaped	Linear dsDNA	Rudivirus
9	Fuselloviridae	Non-enveloped, lemon shaped	Circular dsDNA	SSV-1
10	Inoviridae	Non-enveloped, filamentous	Circular ssDNA	Coliphage fd, MS2, ϕx174
11	Microviridae	Non-enveloped, isometric	Circular dsDNA	Spiroplasma
12	Leviviridae	Non-enveloped, isometric	Linear ssRNA	Coliphage Qβ
13	Cystoviridae	Enveloped, Spherical	Segmented dsRNA	ϕ6

Virus as tool in modern biological research

- Virus is now used in various domains of science such as in:
  - antiviral research,
  - novel therapeutics and vaccine design,
  - cancer research,
  - targeted delivery,
  - imaging or nanotechnologies to cite only a few ranging from biology to nanotechnologies.

... Virus as tool in modern biological research

- Bacteriophages can relatively easily grown as viral phaques on bacterial cultures.
- Bacteriophages occasionally move genetic material from one bacterial cell to another in a process known as transduction and this horizontal gene transfer is one reason why they served as a major research tool in the early development of molecular biology.
- The genetic code, the function of ribozymes, the first recombinant DNA and early genetic libraries were all arrived at using bacteriophages..
- Certain genetic elements derived from viruses, such as highly effective promoters, are commonly used in molecular biology research today.
- Since some viruses that infect eukaryotes need to transport their genetic material into host cells nucleus, they are attractive tools for introducing new genes into the host. Modified retroviruses are often used for this purpose, as they integrate their genes into the host's chromosome.
- The approach of using viruses as gene vectors is being pursued in the gene therapy of genetic diseases. An obvious problem to be overcome in viral gene therapy is the rejection of the transforming virus by the immune system.

... Virus as tool in modern biological research

- Phage therapy, the use of bacteriophage to combat bacterial disease, was a popular research topic before the advent of antibiotics and has recently seen renewed research.
- British bacteriologist Ernest Hankin in 1895 with two holy rivers of India (Ganga, Yamuna) – took the shape of phage therapy.
  - Treated D'Herelle (1919) a 12 year old boy suffering from severe dysentry
- Richard Bruynoghe & Joseph Maisin (1921)- treat Staphylococcal skin infection.
- Oncolytic viruses are viruses that preferably infect cancer cells. While early efforts to employ these viruses in the therapy of cancer failed, these have been reports in 2005 and 2006 of encouraging preliminary results.
- Peptide display by filamentous bacteriophage allowed the identification of molecules able to bind to inorganic materials and eventually, peptides with selectivity for binding to metal surfaces.
- Molecules with such affinities as well as the highly organised structure of the bacteriophage particle are elements extensively exploited in the construction of periodically ordered nanomaterials such as nanometre-scale electronic and medical materials.