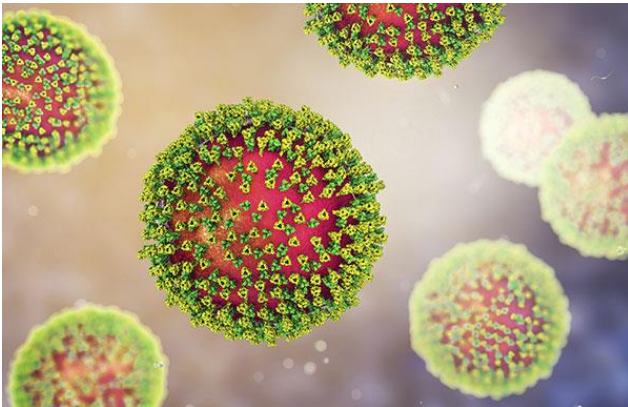


# MS2 bacteriophage

Shilpa Deshpande Kaistha

Department of Biotechnology

CSJM University Kanpur

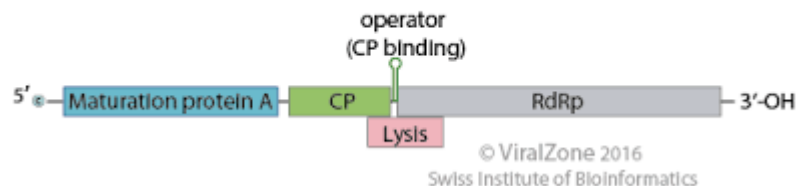
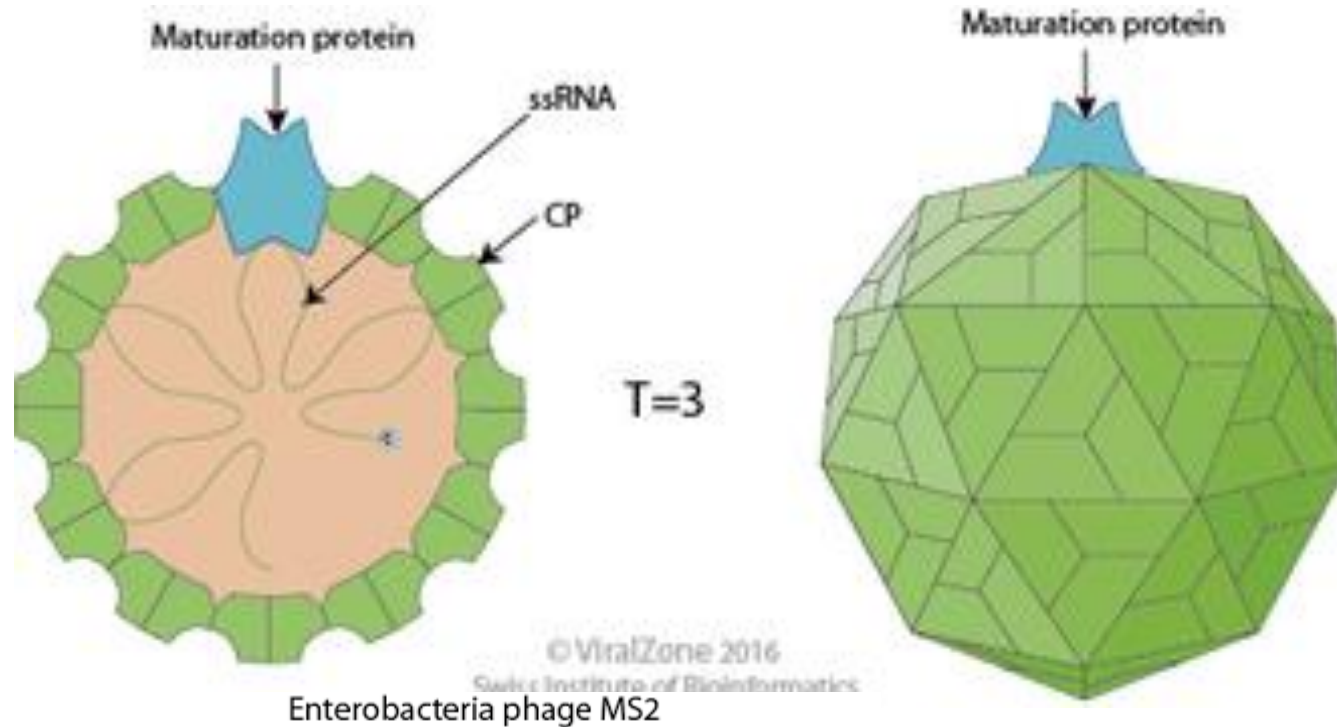


# MS2

- Bacteriophage MS2 (*Emesvirus zinderi*), commonly called MS2, is an icosahedral, positive-sense single-stranded RNA virus that infects the bacterium *Escherichia coli* and other members of the Enterobacteriaceae.
- MS2 is a member of a family of closely related bacterial viruses that includes bacteriophage f2, bacteriophage Q $\beta$ , R17, and GA.

Realm:	<a href="#">Riboviria</a>
Kingdom:	<a href="#">Orthornavirae</a>
Phylum:	<a href="#">Lenarviricota</a>
Class:	<a href="#">Leviviricetes</a>
Family:	<a href="#">Fiersviridae</a>
Genus:	<a href="#">Emesvirus</a>
Species:	<b><i>Emesvirus zinderi</i></b>

# Structure and Genome

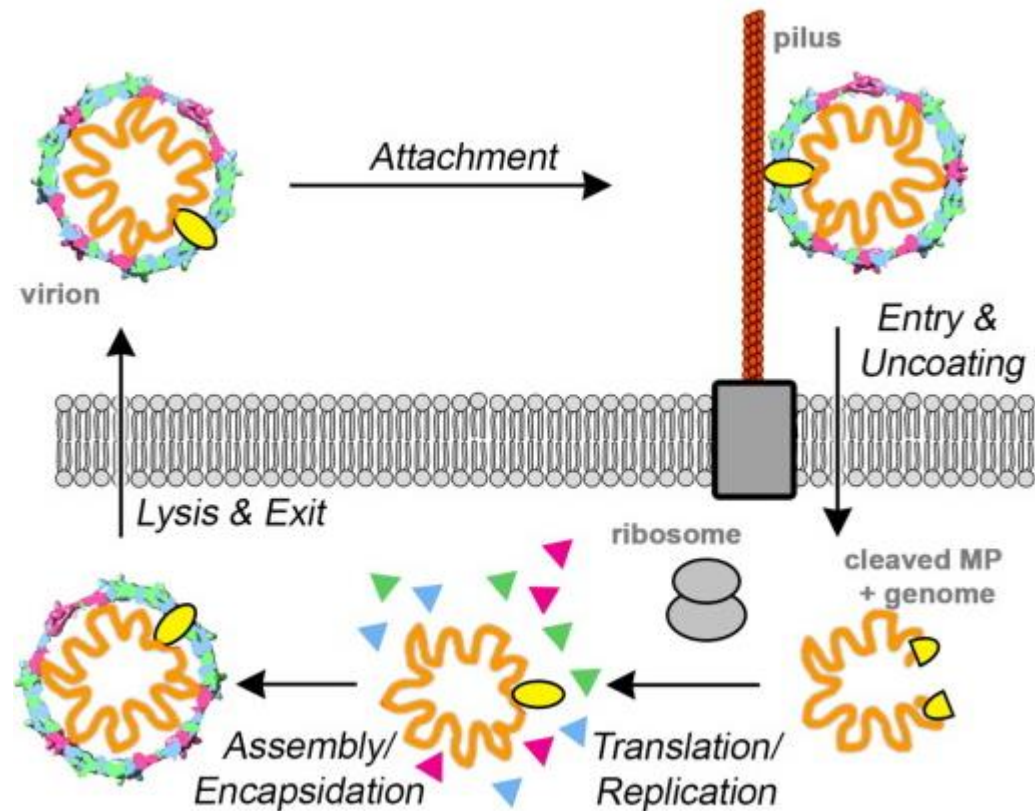


MS2 is a non-enveloped icosahedral phage consisting of 180 identical 129-amino acid coat protein subunits of ~ 14 kDa that form the icosahedral face for a T = 3 surface lattice

[MS2 genome](#) is one of the smallest known, consisting of 3569 nucleotides of single-stranded RNA. It encodes just four proteins:

- maturation protein (A-protein),
- [lysis](#) protein,
- coat protein, and
- [replicase](#) protein.

# wikipedia



MS2 infects enteric bacteria carrying the fertility (F) factor, a plasmid that allows cells to serve as DNA donors in bacterial conjugation

Once the viral RNA has entered the cell, it begins to function as a **messenger RNA** for the production of phage proteins.

Replication of the plus-strand MS2 genome requires synthesis of the complementary minus strand RNA, which can then be used as a template for synthesis of a new plus strand RNA

# Assembly and Lysis

- The assembly of the icosahedral shell or [capsid](#) from coat proteins can occur in the absence of RNA; however, capsid assembly is nucleated by coat protein dimer binding to the operator hairpin, and assembly occurs at much lower concentrations of coat protein when MS2 RNA is present.
- Bacterial lysis and release of newly formed virions occurs when sufficient lysis protein has accumulated. Lysis (L) protein forms pores in the cytoplasmic membrane, which leads to loss of [membrane potential](#) and breakdown of the [cell wall](#). The lysis protein is known to bind to [DnaJ](#) via an important P330 residue.
- Coat protein represses replicase translation by binding a RNA hairpin at the start site of this gene.

# Applications

- Since 1998, the MS2 operator hairpin and coat protein have found utility in the detection of RNA, RNA image trafficking in living cells.
- As a model to determine RNA quantification methods
  - • For RNA extraction
  - • For stabilizing RNA during cDNA synthesis
  - • For studying the use of natural RNA in an in vitro and in vivo system. It serves the purpose of protein-synthesizing, elongation, initiation, and termination of polypeptide synthesis
  - • For various functional and structural studies
  - • For increasing the yield of RNA at the time of RNA isolation or extraction
- COVID monitoring kits **TaqPath COVID-19 Assay Multiplex** – multiplexed assays have 3 primer/probe sets precise to diverse SARS-CoV-2 genomic areas and primers/probes for Bacteriophage MS2
- • **MS2 Phage Control** – A RNA control to validate the effectiveness of the sample research and the absence of inhibitors in the PCR reaction; to execute the control, adding 10 µL of MS2 Phage Control to the samples before extracting the RNA
- MS2 VLPs are also currently under investigation as agents in drug delivery, [tumor imaging](#), and light harvesting applications.
- MS2 can be used in wastewater management and as an indicator virus, which in size is 23-28 nm. Morphology and size are closely related to the Picornaviridae family that comprises various viruses that are pathogenic to humans, including poliovirus.
- The coat proteins of MS2 VLP can be recombinantly expressed and assembled in bacteria and yeasts for platforms of vaccines and peptide epitope identification

# Reference

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