Viruses

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Viruses

Latin meaning "Poison"

The study of viruses is known as Virology

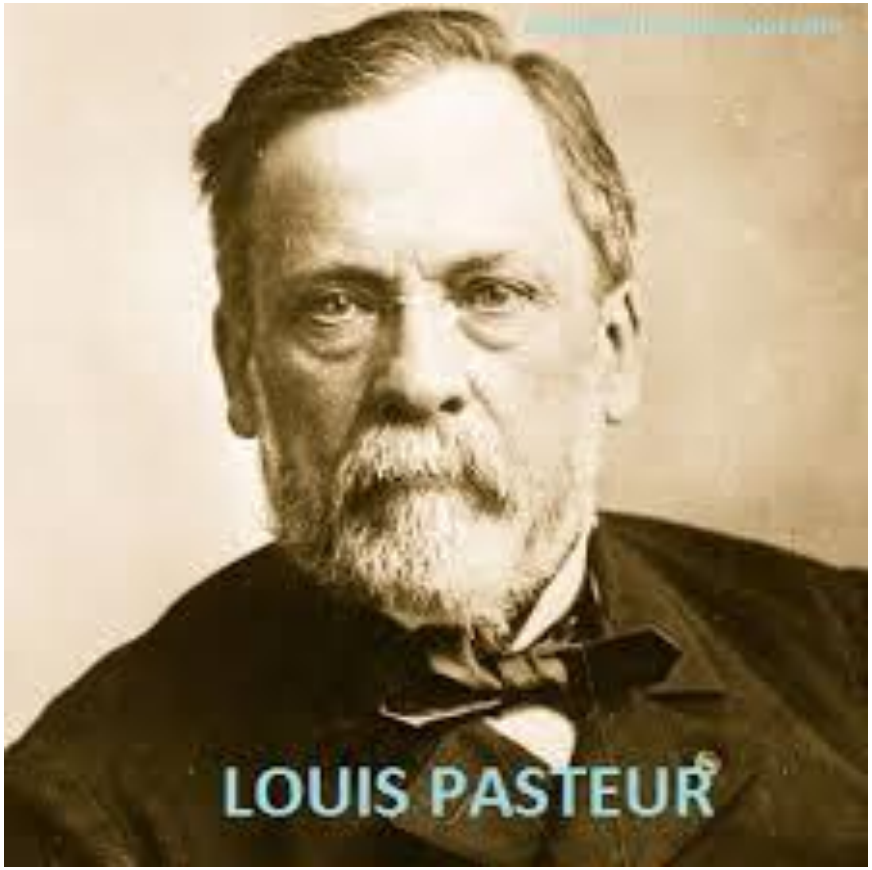
Definition:

Non cellular infectious particles whose genome is nucleic acid either DNA or RNA, which reproduces only in living host.

They are small ultra microscopic particles composed of two types of substances : Protein and Nucleic acid and are visible only under Electron microscope.

They are small particles comprising of a core of nucleic acids (DNA/RNA), surrounded by a protein coat called capsid

A painting of Dr. Edward Jenner (1749–1823) performing his first vaccination on James Phipps, a boy of 8, on May 14, 1796.
Painting by E. Board



History:

Louis Pasteur was unable to find a causative agent for rabies and speculated about a pathogen too small to be detected using a microscope.

In 1884, the French microbiologist Charles Chamberland invented a filter (known today as theChamberland filter or Chamberland–Pasteur filter) with pores smaller than bacteria. Thus, he could pass a solution containing bacteria through the filter and completely remove them from the solution.

Dmitri Ivanovsky

In 1892, the Russian biologist Dmitri Ivanovsky used this filter to study what is now known as the tobacco mosaic virus. His experiments showed that crushed leaf extracts from infected tobacco plants remain infectious after filtration. Ivanovsky suggested the infection might be caused by a toxin produced by bacteria, but did not pursue the idea.

Martinus Beijerinck

In 1898, the Dutch microbiologist Martinus Beijerinck repeated the experiments and became convinced that the filtered solution contained a new form of infectious agent. He observed that the agent multiplied only in cells that were dividing, but as his experiments did not show that it was made of particles, he called it a *contagium vivum fluidum* (soluble living germ) and re-introduced the word *virus*.

Beijerinck maintained that viruses were liquid in nature,

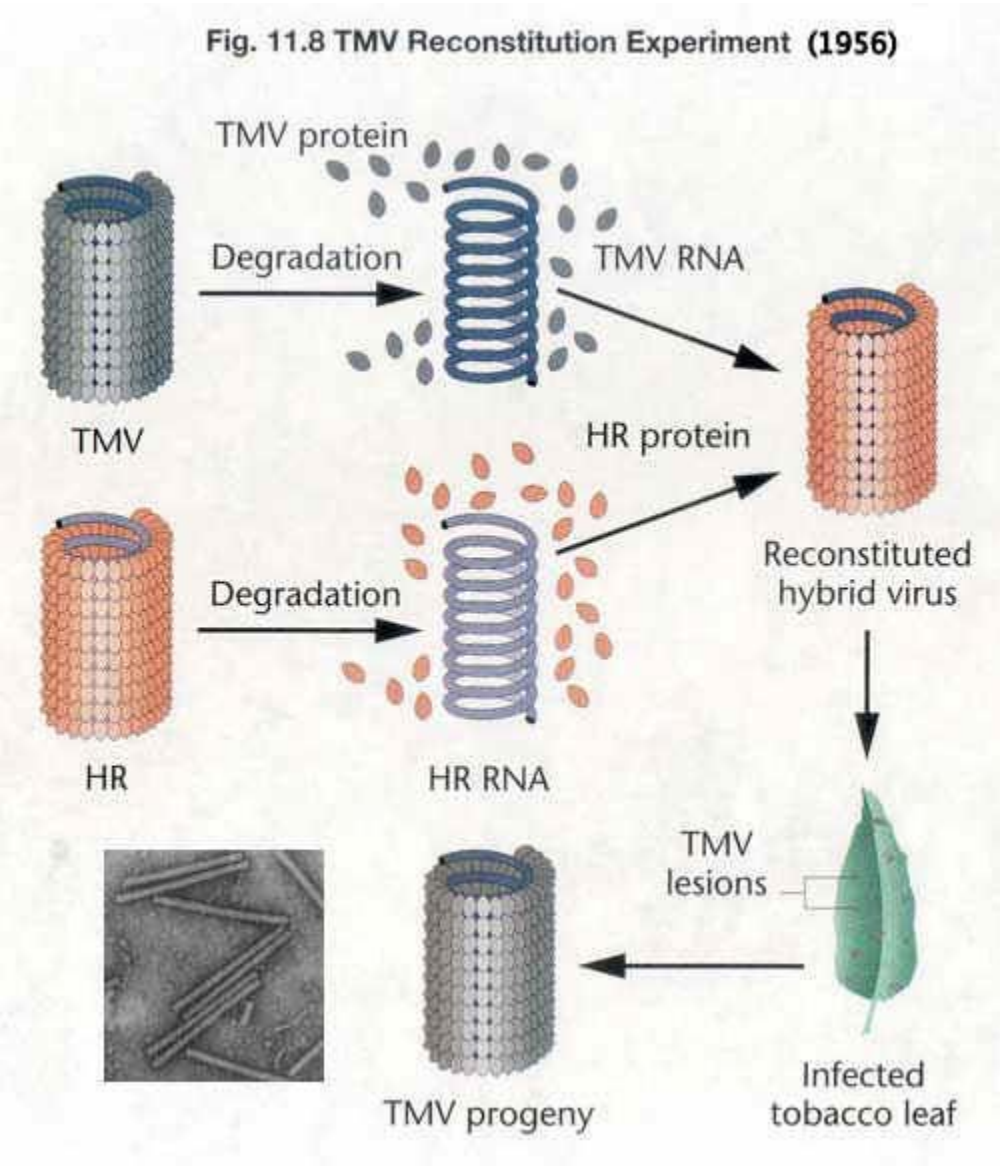
Two major breakthrough in the discovery of viruses

W. M. Stanely

1935 W. M. Stanely crystallized the Tobacco Mosaic Virus and stated the particulate nature of viruses he said that viruses are infective even if they are stored for indefinite period

1938
Two british biochemist
Bawden and Pirie
Gave the chemical nature of Viruses.
And said that Viruses are made up of Protein and Nucleic acid

1956 Heinz Frankel Conrat confirmed that the genetic material of TMV is RNA



In the early 20th century, the English bacteriologist Frederick Twort discovered a group of viruses that infect bacteria, now called bacteriophages (or commonly *phages*), and the French-Canadian microbiologist Félix d'Herelle also described Bacteriophages

Frederick Twort

Félix d'Herelle

1952: **Harshey and Chase** studied in detail T2phage virus

1982: **Hollings** discovered Mycophages

1963: **Safframan and Morris** discovered Cyanophages

1966: **Kassianis** discovered Sattellite virus

1967: **T.O. Diener** and **Raymer** discovered Viroids

1982: **Prusiner** discovered Prions

1983: **Luc Montagnier** discovered HIV Virus

1963: **Baruch Blumberg** Hepatitis B Virus

2009 : H1N1 swine flu virus: Swine influenza, also called **pig influenza**, **swine flu**, **hog flu** and **pig flu**, is an infection caused by any one of several types of swine influenza viruses

Dengue Virus – A Flavivirus

- **Flavivirus** are spherical and 40- 60 mm in diameter.

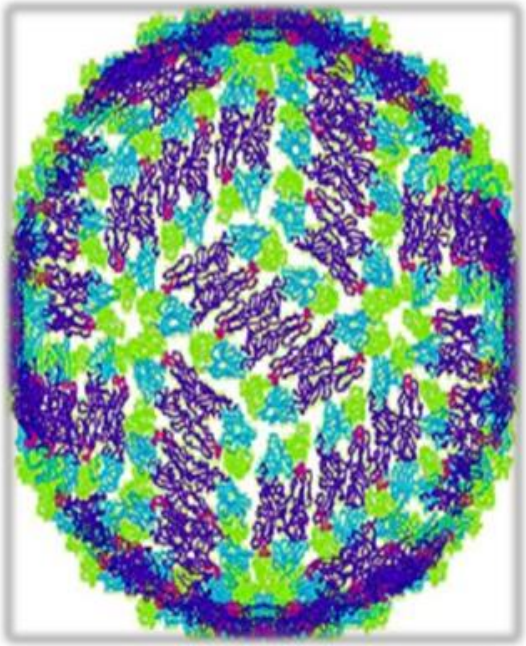
Genome – Positive sense, single sense RNA,11kb in size

Genome – RNA infectious

Enveloped virus

Three structural polypeptides two are glycosylated

Replication in cytoplasm



Acellular Agents

- viruses – protein and nucleic acid
- viroids – only RNA
- virusoids – only RNA
- prions – proteins only

Pleural of Virus- Vira

Virions:

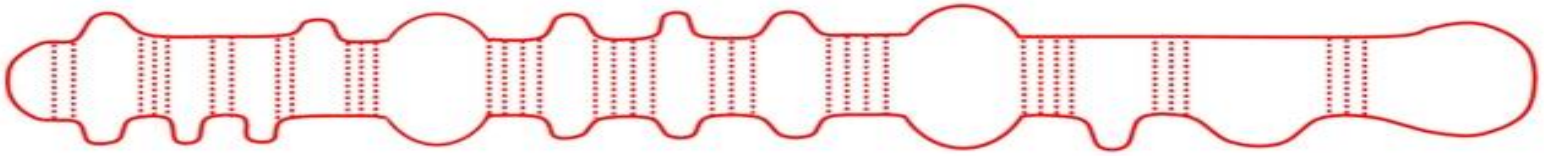
The complete virus particle comprising of nucleic acid, protien coat and envelope if any

Viroids:

The smallest known infectious disease comprising of a small stranded molecule of RNA (200-400 nucleotide long) . Viroids lack capsids and no protiens are found. Discovered by T. O. Diener 1971

Diseases caused by Viroids:

Potato spindle tuber disease
Citrus exo cortis disease
apple scar skin disease viroid.



Structure of a viroid – circular single-stranded RNA with some pairing between complementary bases and loops where no such pairing occurs

Viroids

- Circular, ss RNA molecules of low mol. Wt. that mainly cause diseases in plants.
- Smallest known infectious agents.
- Don't code for any proteins– disrupt protein synthesis mechanisms in plants.
- Discovered by T. O. Diener (1971), associated with Potato Spindle Disease
- 1,00,000 – 1,40,000 d in size
- No protein coat like viruses
- 2 groups - ***Pospiviroidae*** (Ex. **P**otato **S**pindle **T**uber **V**iroi**d**, PSTVd) & ***Avsunviroidae*** (Ex. **A**vocado **S**un**B**lotch**V**iroi**D** ASBVd).

Virusoids

1. Discovered by Rendel.
2. They are same as Viroids but located inside the envelope of a true virus.
3. They are not infectious by themselves and they replicate themselves inside the host.
4. Formerly called as satellite RNAs
5. Covalently closed circular RNAs which encode for one or more gene products.
6. Require a helper virus for replication.
7. Diseases: Tobacco necrosis satellite virus and
8. Human Hepatitis D virus is a Virusoid which requires Human Hepatitis B virus as helper virus

The differences between viroids and virusoids can be seen in the table below:

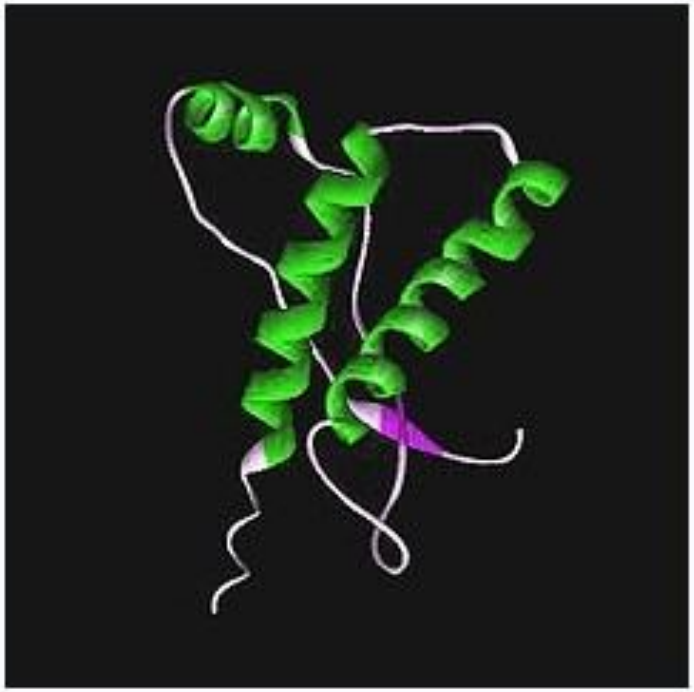
	Viroids	Virusoids (Satellites)
Genome Size	200-400 bases	500-2000 bases
Requires helper virus for replication?	No	Yes
Encodes proteins?	No	Yes
Replication Mediator	Host RNA Pol II	Helper virus polymerase
Site of Replication	Nucleus	Where helper virus replicates
Example	Potato spindle tuber viroid (PSTVd)	Tobacco ringspot virus satellite RNA

PRIONS ????????

- A prion is a *pro*teinaceous *in*fectious particle
  - A protein that infects like a virus
- These diseases run in families; however, they can't be totally inherited
- There is a lot that is not known about prions
  - Mad Cow disease
  - Kuru
  - Creutzfeldt-Jakob disease
  - Fatal familial insomnia
  - Gerstmann-Straussler-Scheinker syndrome

What the heck are prions for?

Posted by **ajcann** on May 21, 2008



Prions are proteinaceous infectious agents that were first discovered because of their role in the etiology of transmissible spongiform encephalopathies (TSEs), a set of fatal neurological disorders that include Creutzfeldt-Jakob disease, scrapie and bovine spongiform encephalitis. TSEs arise from progressive misfolding of the endogenous cellular prion protein (Prp [PrPC]) into disease-associated scrapie form (PrPSc), which, in turn, disrupts normal cellular function and results in the formation of aggregates and amyloid-like plaques. Although there has been a clear association between PrPSc with these disease states, the cellular function of PrPC remains incompletely understood. PrPC is expressed across the entire central nervous system and at particularly high levels in the hippocampus, striatum, and frontal cortex, with apparently wide subcellular distribution, including synaptic sites. A synaptic role of PrPC is consistent with evidence from PrP-null mice showing deficits in spatial learning, altered long-term potentiation and increased excitability of hippocampal neurons. Several studies have also suggested that PrPC may provide neuroprotection. For example, cultured hippocampal neurons obtained from PrP-null mice show an increased apoptosis during oxidative stress. Mice lacking PrPC show increased neuronal damage after ischemic stroke, whereas protection is evident upon the viral-based overexpression of PrPC in rats. Finally, in several in vivo models of seizure activity, PrP-null mice showed increased mortality, likely as a consequence of hyperexcitability leading to excitotoxicity. The cellular and molecular basis for these effects remains unknown. Recent research shows that PrPC exerts a neuroprotective role by inhibiting excitotoxic cell death and that PrPC is a modulator of synaptic function and, consequently, neuronal excitability.