

## Lecture: Ivanovsky

**Alive from:** 1864-1920

**Country of Origin:** Russia

**Education/Training:**

**Contributions/Accomplishments:**

- although Pasteur and Jenner made vaccines against viruses, however they did not know of their existence
- Ivanovsky was sent to investigate a tobacco disease that was devastating tobacco farms in Ukraine and Bessarabia (now mostly Moldova/Moldavia)
- in 1892, he used a special porcelain filter (Chamberland filter) that removed all bacteria ( )
- the solution that was left was able to cause disease in tobacco plants
- Ivanovsky thought that the solution contained a bacterial toxin that was causing the tobacco mosaic disease (he was wrong!)
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## Lecture: Beijerinck

**Alive from:** 1851-1931

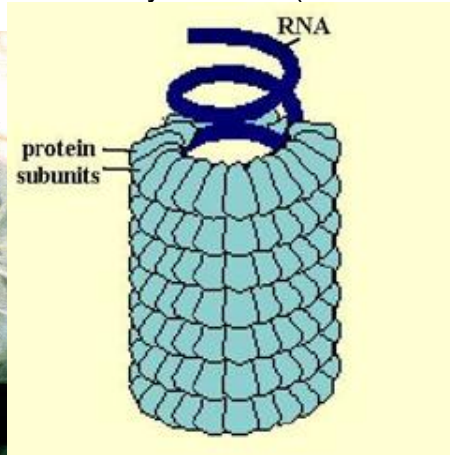
**Country of Origin:** Netherlands

**Education/Training:**

**Contributions/Accomplishments:**

- Beijerinck is one of the founders of virology ( )
- in 1898, Beijerinck published results of his repetition of the filtration experiment done by Ivanovsky
- Beijerinck named the infectious solution "virus" ( ) which was a reintroduction of the term "virus" from 1728 when it was first used to describe an agent of infectious disease
- Beijerinck could not culture the tobacco mosaic virus so he knew it was not a bacterium
- he believed the virus to be "somewhat liquid in nature" so he called it "contagium vivum fluidum" ( ) or more generally a soluble living germ
- this fluid could infect other tobacco plants and cause tobacco mosaic disease

- Tobacco Mosaic Virus ( ) can infect a wide variety of plants: tobacco, tomatoes, peppers, cucumbers, and many ornamental plants like orchids
- TMV is a “promiscuous” virus; it can infect a wide variety of hosts ( )

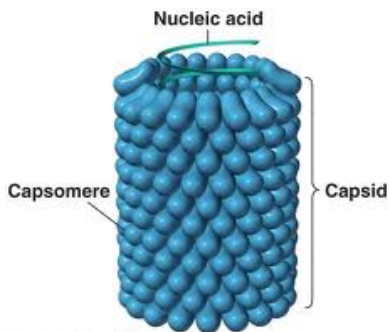


### Viruses: Characteristics and Structure

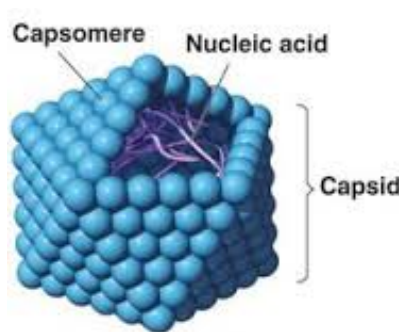
- a virus is a piece of nucleic acid ( ) surrounded by a coat of protein, with or without a fatty membrane envelope ( )
- viruses are not generally considered to be living organisms
- viruses are parasites (they live at the expense of the host, usually doing harm)
- viruses cannot reproduce independently ( )
- viruses do not possess the cellular machinery needed to reproduce
- all living organisms are hosts for a virus (plants, animals, protozoa, bacteria, fungi, and archaea)
- some viruses are parasites of other viruses ( )

### The Protein Coat (Capsid)

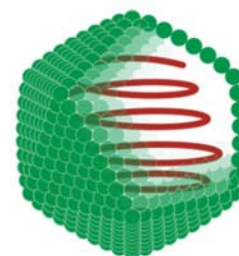
- capsids are made of regular repeating protein subunits ( )
- capsids are usually very geometric (helical, polyhedral, icosahedral ( ))



(a) A helical virus  
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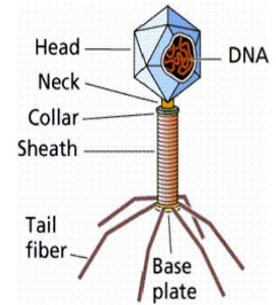


(a) A polyhedral virus  
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Icosahedral  
Rhinovirus

- bacteriophages ( ) are complex viruses; they have additional protein structures

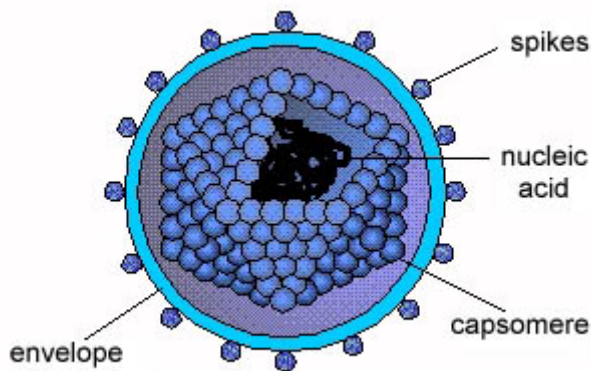


### The Nucleic Acid (DNA or RNA)

- viruses contain either DNA or RNA but not both of them. Living cells have both of them. These nucleic acids can either double stranded or single stranded. (Next lecture we will learn about DNA and RNA and how living cells use them.)

### The Membrane Envelope (if present)

- some viruses have a fatty (lipid) membrane envelope. This envelope was acquired from the host cell. The viruses stole it! Envelopes have protein spikes that the virus uses for attachment to the host cell.



### Study Objectives

1. Describe how Ivanovsky discovered that there was something smaller than bacteria that caused diseases like tobacco mosaic disease.
2. What is the Latin meaning of “virus”?
3. How did Beijerinck know that the tobacco mosaic virus was not a bacterium?
4. Why is TMV a “promiscuous” virus?
5. What did Beijerinck do that Ivanovsky did not to determine what was causing tobacco mosaic disease?
6. What is “contagium vivum fluidum”?
7. Describe at least 6 characteristics of viruses.
8. Describe the structure of a virus. Include capsid, nucleic acid, and membrane envelope.