Virus Introduction

Virus Definition

An infective agent that typically consists of a nucleic acid molecule in a protein coat, is too small to be seen by light microscopy, and is able to multiply only within the living cells of a host.

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a piece of code which is capable of copying itself and typically has a detrimental effect, such as corrupting the system or destroying data.

www.google.com/search

Characteristics of Viruses

1. **Viruses** are infectious agents with both living and nonliving characteristics.
2. Living characteristics: ability to reproduce in hosts
3. Non Living characteristics:
4. They are acellular, that is, they contain no cytoplasm or cellular organelles
5. They carry out no **metabolism** on their own and must replicate using the host **cell's** metabolic machinery. In other words, viruses don't grow and divide
6. Obligate intracellular parasites
7. Structure: genome enclosed in a protein coat/capsid. Sometimes lipid envelop
8. The vast majority of viruses possess either **DNA** or RNA but not both.
9. They mutate
10. These include a process called antigenic drift where individual bases in the DNA or RNA (point mutation)mutate to other bases. Antigenic shift occurs when there is a major change in the genome of the virus. This can be a result of recombination or reassortment. Eg influenza virus pandemic

Virus genome size (Wikipedia)

-Genome sizes of bacteriophages and viruses range from about **2 kb** to over 1 Mb. **The smallest—the ssDNA circoviruses, family *Circoviridae*—code for only two proteins and have a genome size of only two kilobases; the largest—the pandoraviruses—have genome sizes of around two megabases which code for about 2500 proteins. Virus genes rarely have introns and often are arranged in the genome so that they overlap**

-Prokaryotic genomes range from about **500 kb** to about 12 Mb.

-Eukaryotic genomes are diverse in size, ranging from ~10 Mb in some fungi to >100 000 Mb in certain plants, salamanders, and lungfishes.

UNIQUE ABOUT VIRAL GENOME

Viral genomes consist of DNA or RNA only, never both. DNA and RNA molecules can be double stranded or single stranded, linear or circular , segmented (composed of multiple pieces of nucleic acid) or nonsegmented.

Evolution of Viruses www.wikipedia.org/wiki/virus

viruses do not fossilize, so researchers can only hypothesize about viruses' evolutionary history by investigating how today's viruses evolve and by using biochemical and genetic information to create speculative virus histories.While most findings agree that viruses don't have a single common ancestor, scholars have yet to find a single hypothesis about virus origins that is fully accepted in the field—and that fully explains viruses and their characteristics. There are, however, three hypotheses that have risen as the most accepted:

- **Devolution** or **regressive hypothesis**. This hypothesis proposes to explain the origin of viruses by suggesting that viruses evolved from free-living cells. However, many components of how this process might have occurred are a mystery.
- **Escapist** or **progressive hypothesis**. This hypothesis accounts for viruses having either an RNA or a DNA genome and suggests that viruses originated from RNA and DNA molecules that escaped from a host cell. However, this hypothesis doesn't explain the complex capsids and other structures on virus particles.
- **Self-replication hypothesis**. This hypothesis posits a system of self-replication similar to that of other self-replicating molecules, likely evolving alongside the cells they rely on as hosts; studies of some plant pathogens support this hypothesis.

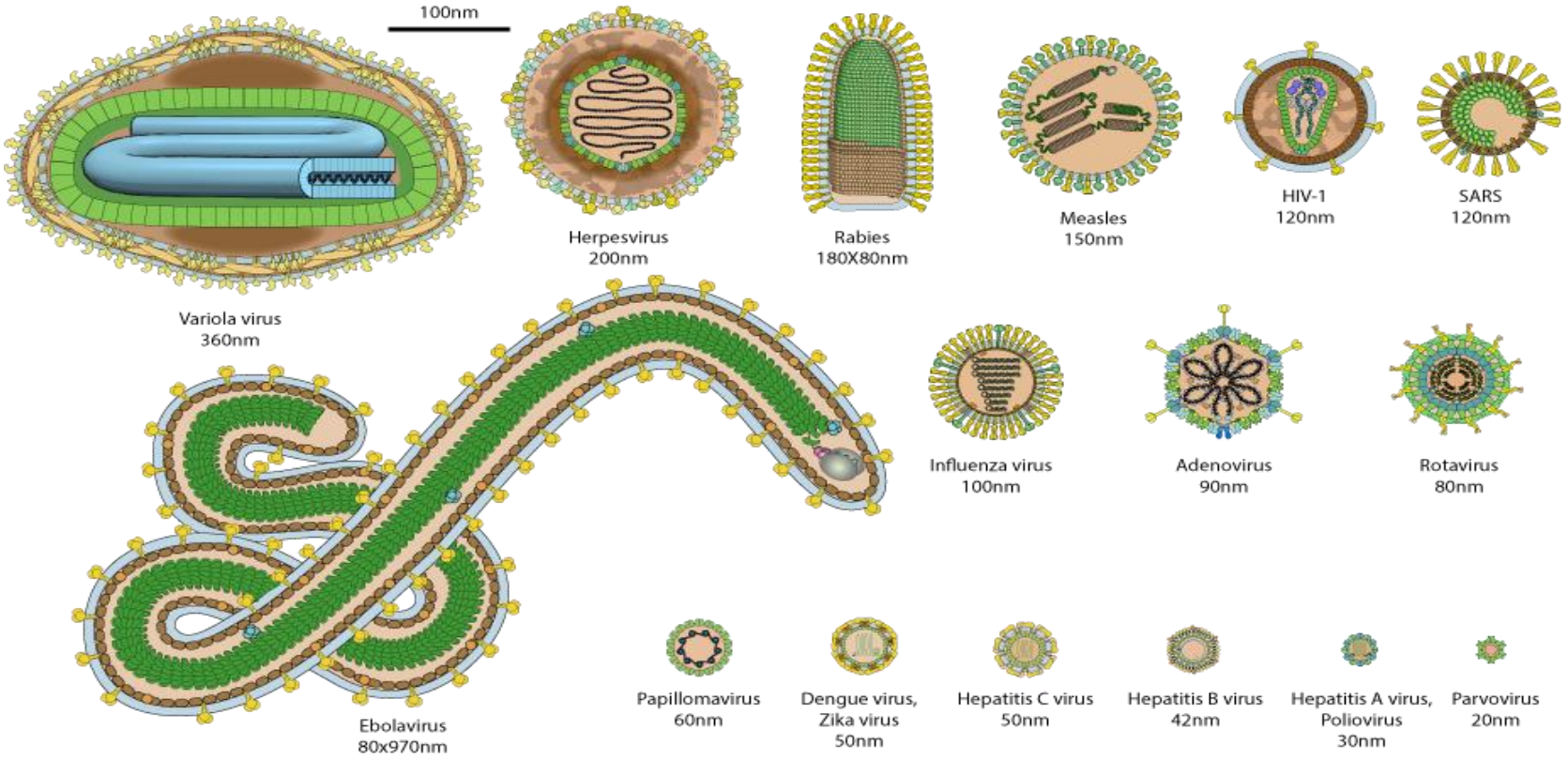
Evolution of Viruses

Synthetic virology is a branch of virology engaged in the study and engineering of **synthetic** man-made **viruses**. It is a multidisciplinary research field at the intersection of virology, **synthetic biology**, computational **biology**, and DNA nanotechnology, from which it borrows and integrates its concepts and methodologies.

Virus Like Particles: They can be naturally occurring or synthesized through the individual expression of viral structural proteins, which can then self assemble into the virus-like structure without genome. Combinations of structural capsid proteins from different viruses can be used to create recombinant VLPs.

A **virus-like particle** is not infectious because it does not contain any **viral** genetic material. As they are very **similar** to real **viral** molecules, introducing a **VLP** into the body will trigger an immune response, but a person will not experience any symptoms of the **virus** they are being **vaccinated** against

Size of Viruses (nanometer….??)



Recent news : Megaphage: 7.5 Mbp genome >200 kbp

Science News

Huge bacteria-eating viruses close gap between life and non-life

Large bacteriophages carry bacterial genes, including CRISPR and ribosomal proteins

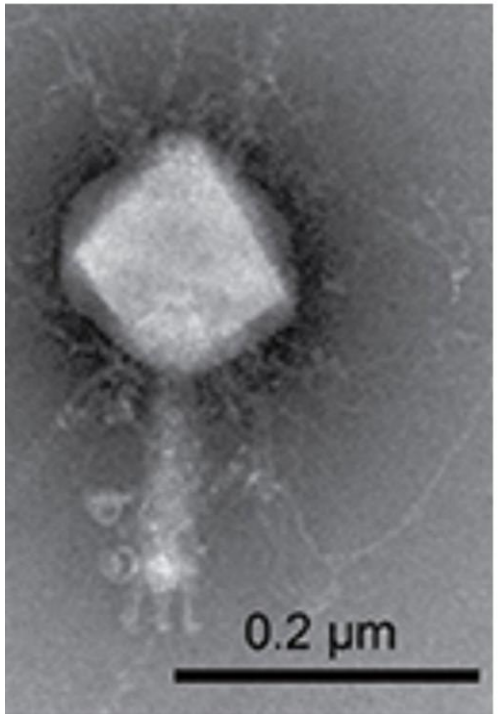
*Date:*February 12, 2020

*Source:*University of California - Berkeley

*Summary:*Bacterial viruses, called bacteriophages, are simple genetic machines, relying on their bacterial hosts to replicate and spread. But scientists have found hundreds of huge phages that carry a slew of bacterial proteins that the phages evidently use to more efficiently manipulate their microbial hosts. These proteins include those involved with ribosomal production of proteins and the CRISPR bacterial immune system, as if the phages are a hybrid between living microbes and viral machines.

GAINT OR JUMBOPHAGES

Giant or jumbo phages are terms used to describe prokaryotic viruses with genomes >200 kb.



frontiers in Microbiology

Larger Than Life: Isolation and Genomic Characterization of a Jumbo Phage That Infects the Bacterial Plant Pathogen, *Agrobacterium tumefaciens*

Hedieh Attai[1], Maarten Boon[2], Kenya Phillips[1], Jean-Paul Noben[3], Rob Lavigne[2] and Pamela J. B. Brown[1*]

[1]Division of Biological Sciences, University of Missouri, Columbia, MO, United States
[2]Laboratory of Gene Technology, KU Leuven, Leuven, Belgium