Title: Virus Diseases of the Grapevine
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WASHINGTON STATE UNIVERSITY
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Virus Diseases of the Grapevine

Lecture 1

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Topics to be covered

- Brief overview of viruses
- Grapevine virus diseases
- Conditions which mimic virus disease symptoms
- Management of grapevine virus diseases

History's most deadly events

Event		Deaths (millions)
HIV/AIDS Pandemic	:	20 (dead) + 40 (living with HIV)
Influenza/Flu Pandemic (1918-1919)	:	20-40
Black Death/Plague (1348-1350)	:	20-25
World War II (1937-1945)	:	15.9
World War I (1914-1918)	:	9.2

Humans are in a constant battle with viruses

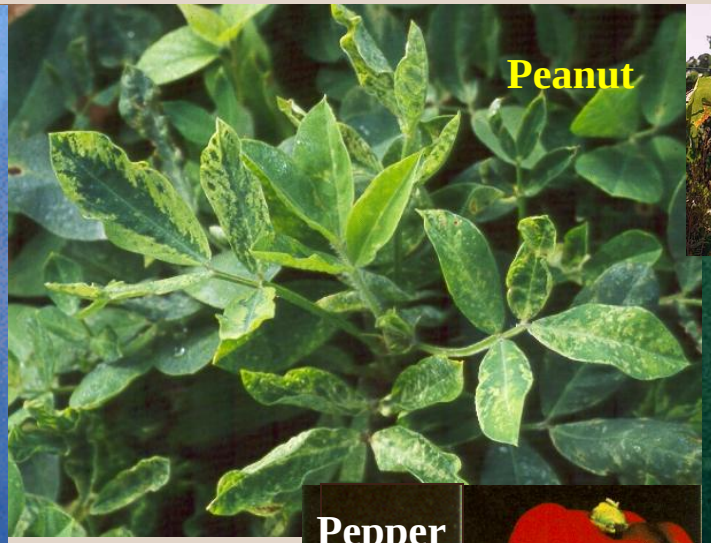
Severe Acquired Respiratory Syndrome (SARS) epidemic

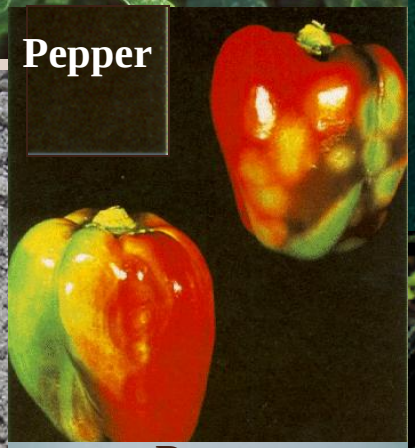
Humans are in a constant battle with viruses

HIV/AIDS pandemic

Mass cull of sheep due to Foot-and-Mouth Virus crisis

Viruses cause damage to agriculture





Some examples of crop losses due to viruses

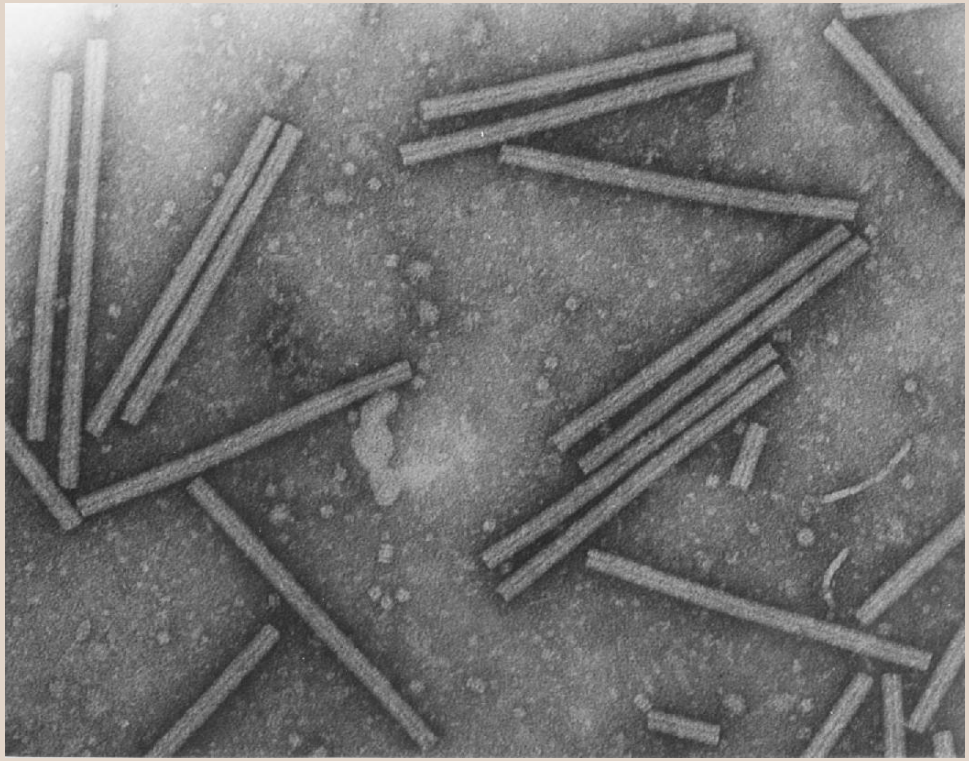
Crop	Virus	Countries	Loss/Year
Rice	Tungro	SE Asia	$\$1.5 \times 10^9$
Rice	Ragged stunt	SE Asia	$\$1.4 \times 10^8$
	Hoja blanca	S. & C. America	$\$9.0 \times 10^6$
Barley	Barley yellow dwarf	UK	$£6 \times 10^6$
Wheat	Barley yellow dwarf	UK	$£5 \times 10^6$
Potato	Potato leafroll	UK	$£3\text{-}5 \times 10^7$
	Potato virus Y		
	Potato virus X		
Sugarbeet	Beet yellows	UK	$£5\text{-}50 \times 10^6$
	Beet mild yellows		
Citrus	Citrus tristeza	Worldwide	$£9\text{-}24 \times 10^6$
Cassava	Africa cassava mosaic	Africa	$\$2 \times 10^9$
Many crops	Tomato spotted wilt	Worldwide	$\$1 \times 10^9$
Cocoa	Cocoa swollen shoot	Ghana	1.9×10^8 trees*

*Number of trees eradicated over about 40 years

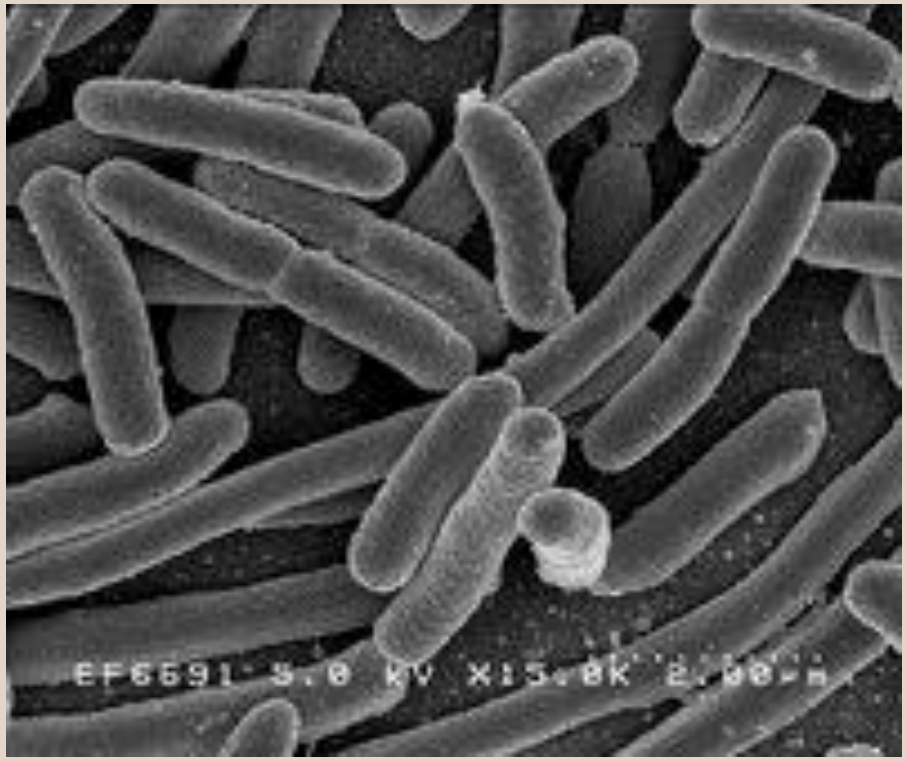
Viruses are very much a part of life on earth

Viruses are different

Virus

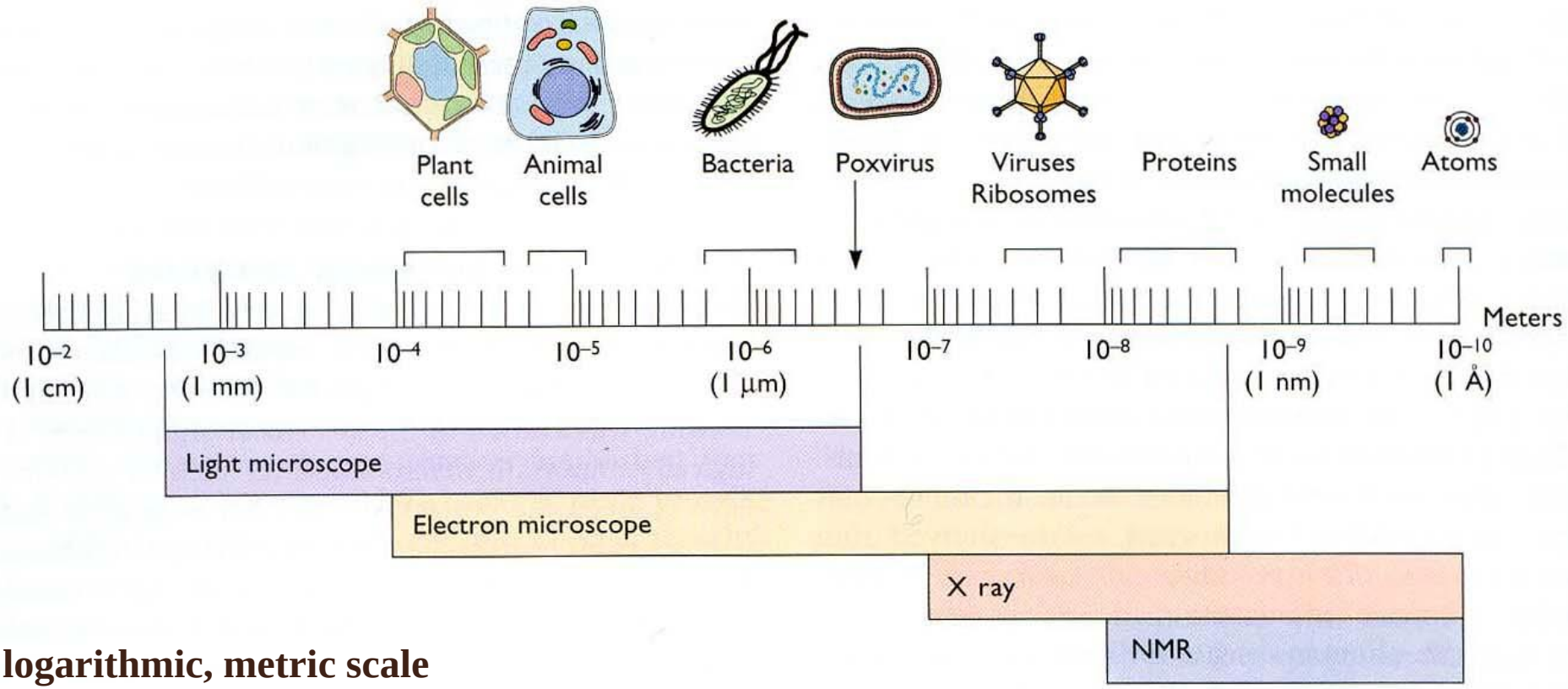


Bacterium



Electron microscope pictures

Viruses are sub-microscopic infective agents

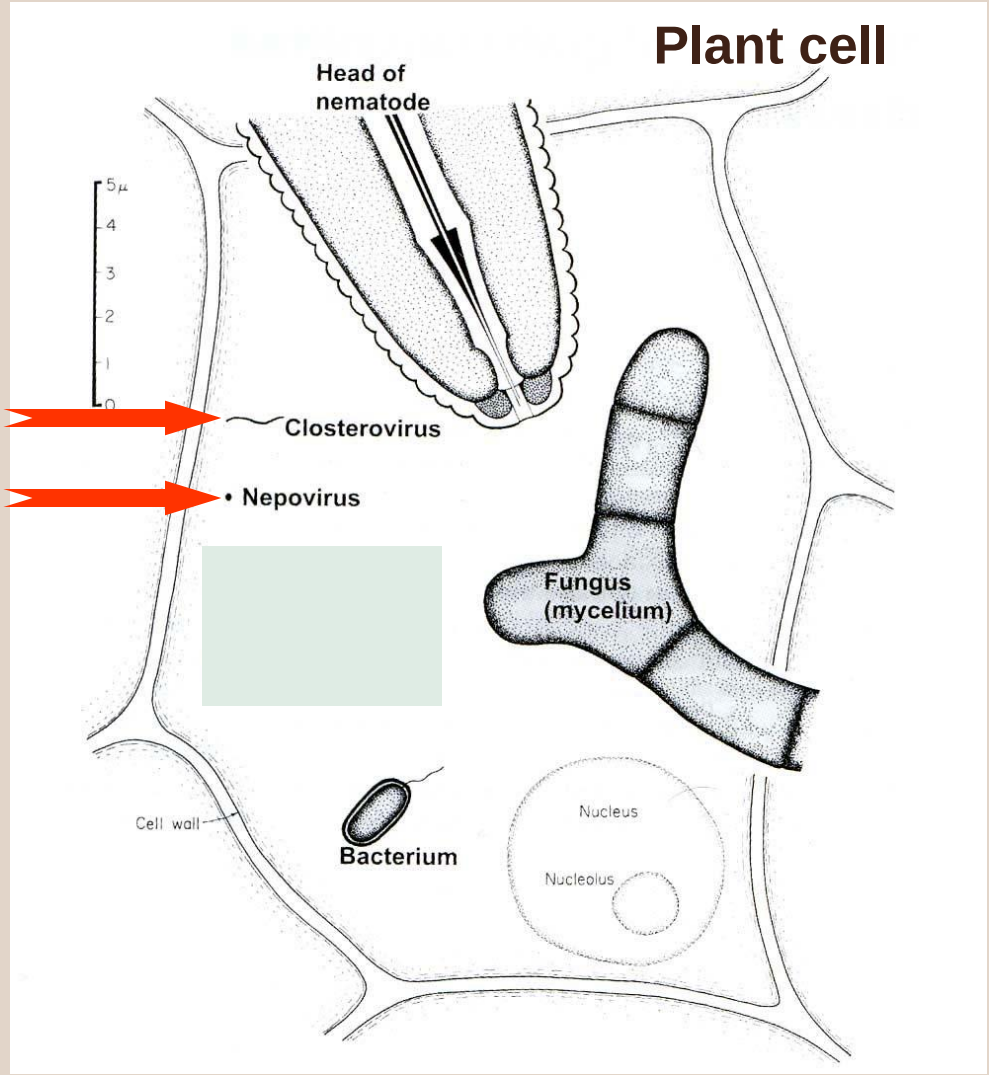


logarithmic, metric scale

The size of viruses relative to different pathogens

Leafroll virus

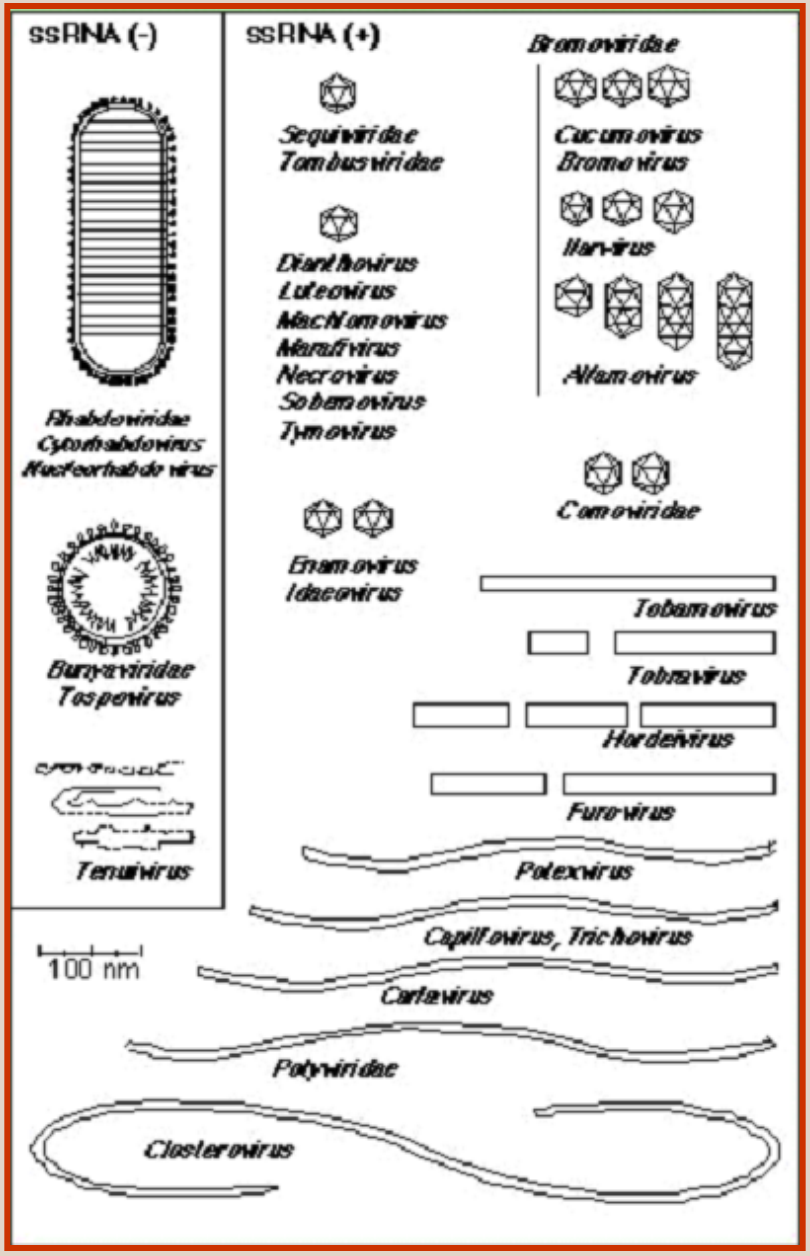
Fanleaf virus

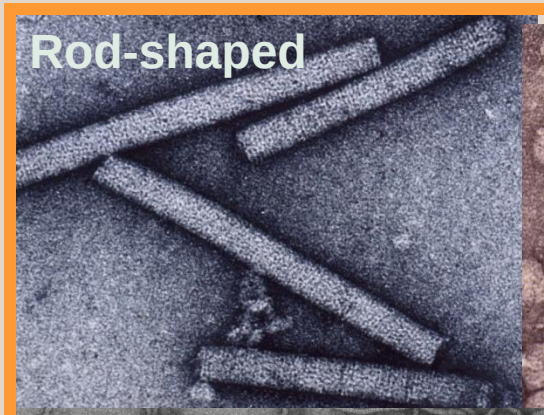


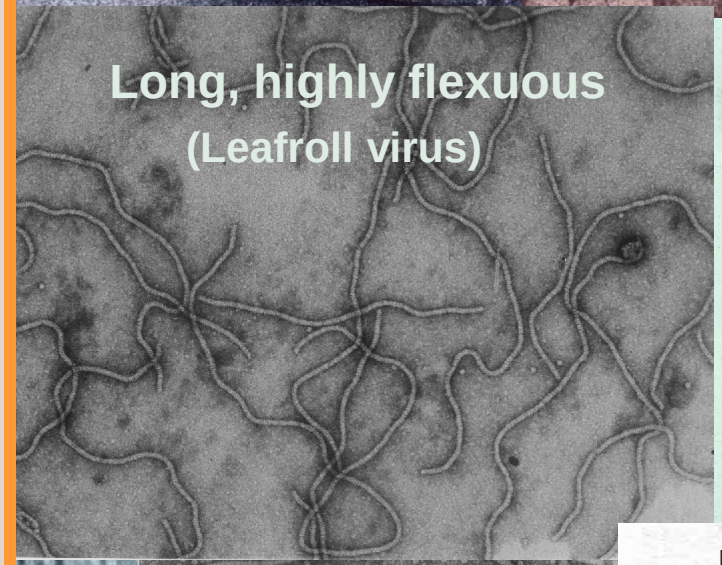
Size of leafroll virus:
Length: 1/500th of a millimeter
Diameter: 1/90,000th of a millimeter

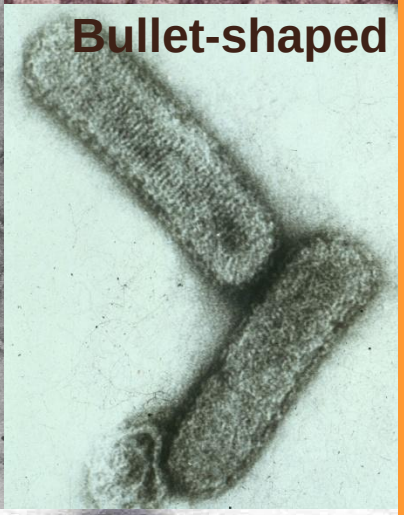
Size of fanleaf virus:
Diameter: 1/40,000th of a millimeter

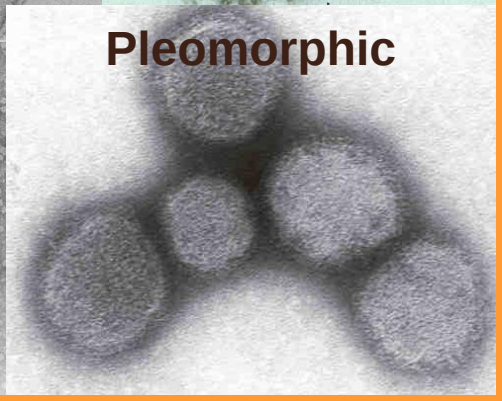
Viruses have different shapes and sizes





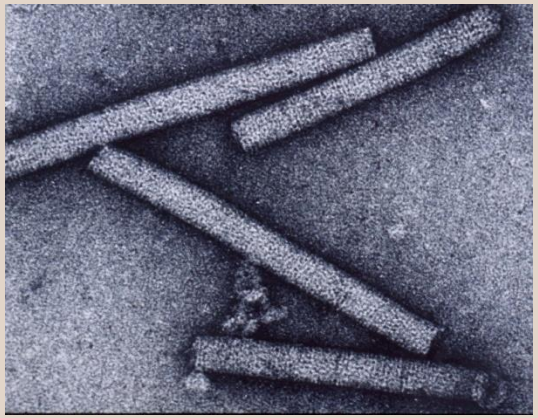




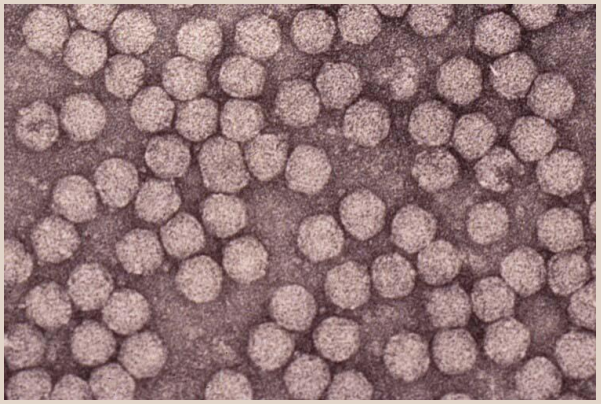


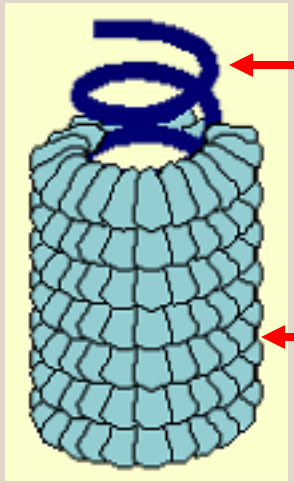
Viruses have simple genomes

Rod shaped viruses



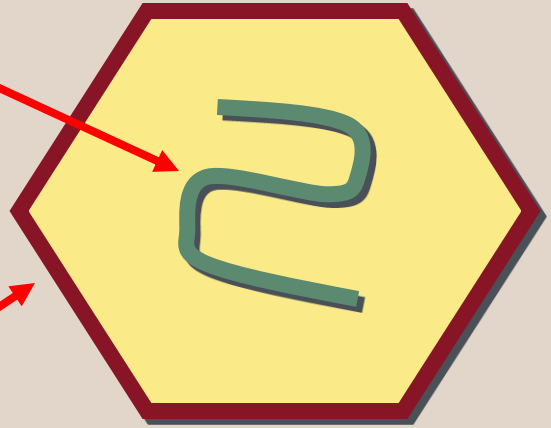
Spherical viruses





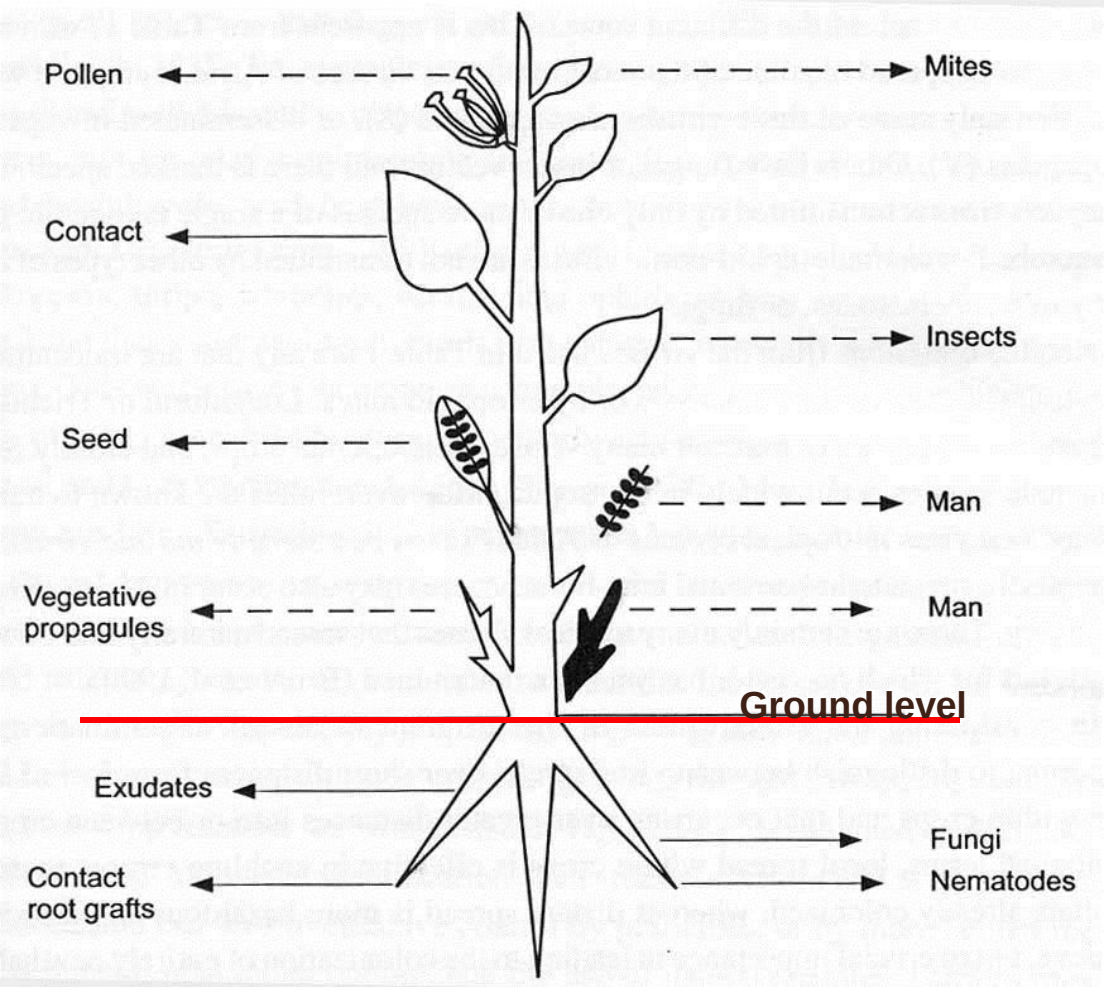
Viral genome
(RNA or DNA)

Coat protein



RNA: Ribonucleic acid
DNA: Deoxyribonucleic acid

Viruses: How do they spread ?



The effectiveness of the different means of virus spread

Method	Local	Distant
Contact	+	-
Seed transmission	+	+
Pollen transmission	+	+
Active vectors	+	+
Less active vectors	+	-
Vegetative propagation	+	+
Soil-borne	+	-

Can we control viruses ?

- No direct method to control viruses
  (e.g. fungicidal chemicals to control fungal diseases,
  antibiotics to control bacterial infections)

- Control methods for viruses are indirect to:
  avoid infection
  prevent infection
  limit spread by insect vectors

- Prevention is better than cure

Holistic approach to prevent losses due to viruses

- Understand the nature of virus
  - characterization
  - strains/variants
  - diagnostic tools
- Find the mode of transmission
  - insect vector
  - seed
  - vegetative cuttings
- Learn ecology and epidemiology
  - spread of virus in time and space
  - cultural practices
  - vector behavior
- Deploy resistant/immune varieties
  - through breeding