

Viruses

- small number of genes
- RNA or DNA stores genetic information
- lipid membrane
- proteins to recognize surface proteins of **target** host cells (determines route of infection, symptoms)
- fuse with host cell
- use host enzymes to make more proteins, RNA/DNA
- new virus assembles and buds off
- If virus is eliminated (or host cell is killed), infection is over

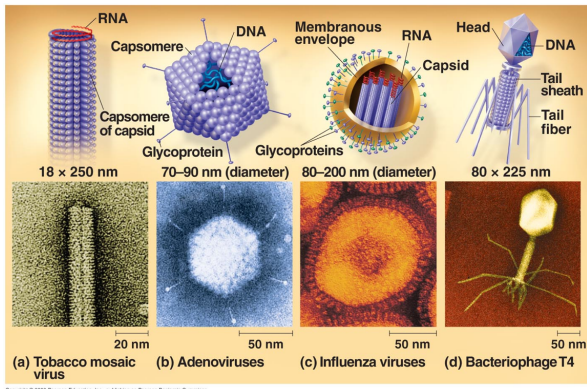
Virus Types 1-7, based how genetic information is stored Not related to severity, or tissue infected, or symptoms!

- I: dsDNA viruses
e.g. Herpes viruses, Pox viruses
- II: ssDNA viruses: sense strand DNA
e.g. Parvoviruses, fifth disease
- III: dsRNA viruses
e.g. Reoviruses/Rotavirus
- IV: (+)ssRNA viruses: sense strand RNA
e.g. Rhinovirus (cold), Polio, Enterovirus D68
- V: (-)ssRNA viruses: antisense RNA
e.g. Rabies, Influenza, Ebola
- VI: ssRNA-RT viruses Retroviruses that convert RNA to DNA
e.g. HIV
- VII: dsDNA-RT viruses
e.g. Hepadnaviruses that infect liver (Hepatitis B)

Relative Size of Viral Genomes

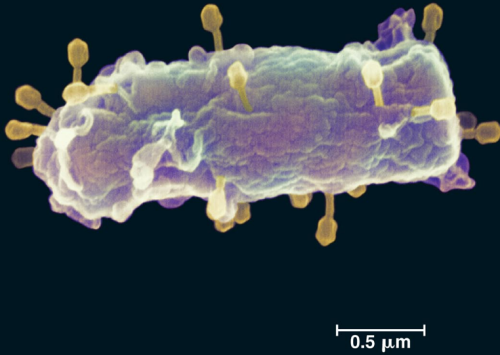
Virus	Type	Genome (nt)	Proteins
<i>Viroids</i>	<i>circ. ssRNA</i>	<i>200-500</i>	<i>0</i>
Enterovirus	ssRNA	7,500	5
HIV	ssRNA	10,000	9
Rabies	ssRNA	12,000	5
Influenza A	ssRNA	14,000	11
Ebola	ssRNA	19,000	7
lambda phage	dsDNA	50,000	14
Varicella ZV	dsDNA	125,000	70
<i>E. coli</i>	<i>dsDNA</i>	<i>4.6 million</i>	<i>4,300</i>
<i>H. sapiens</i>	<i>dsDNA</i>	<i>3.2 billion</i>	<i>20,000</i>

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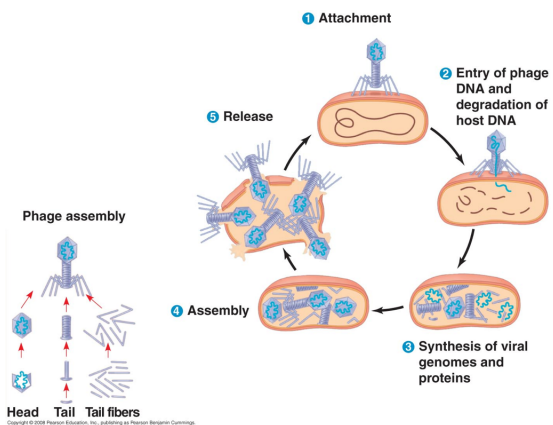
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Bacteriophage: DNA virus that infects *E. coli* bacteria



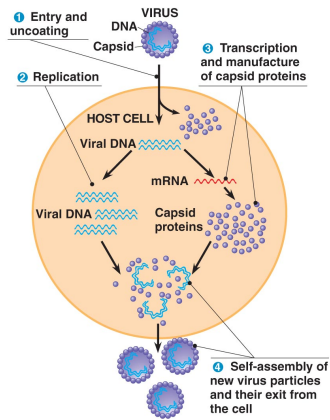
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Bacteriophage: DNA virus that infects *E. coli* bacteria



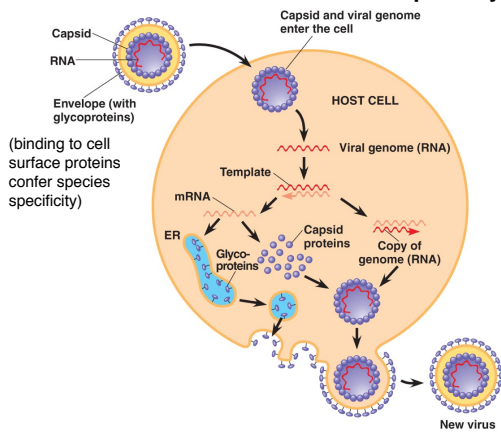
Adenovirus: DNA virus that infects respiratory system

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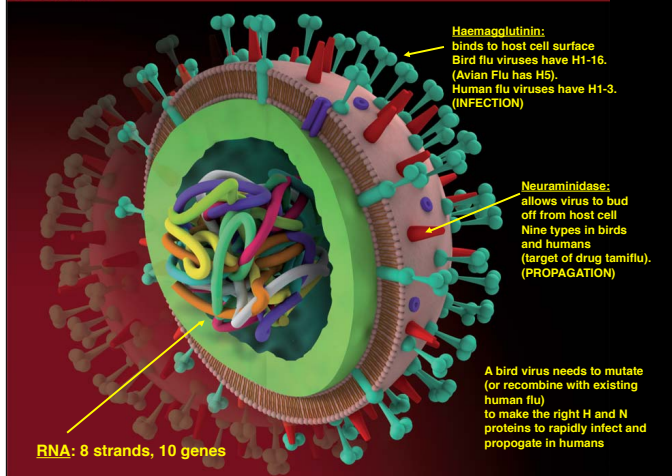
Influenza: RNA virus that infects respiratory system

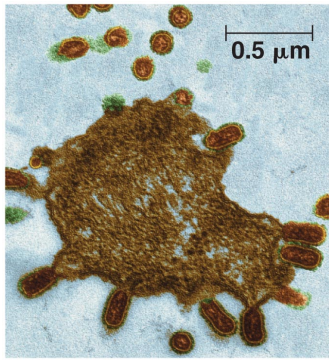
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THE FLU VIRUS

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(b) Influenza A H5N1 virus

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(c) Vaccinating ducks

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Neuronal Viruses climb up nerve fibers to cell bodies

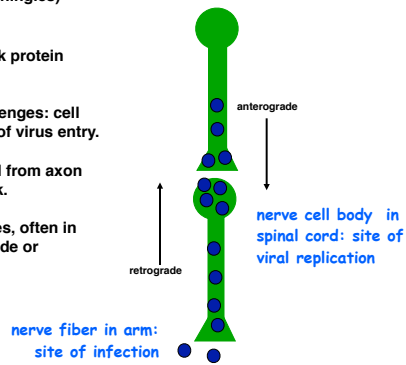
Rabies & Pseudorabies
Herpes Simplex (cold sores)
Vaccinia Roster (chicken pox, shingles)
Polio

Most virus infect cell and hijack protein synthetic machinery

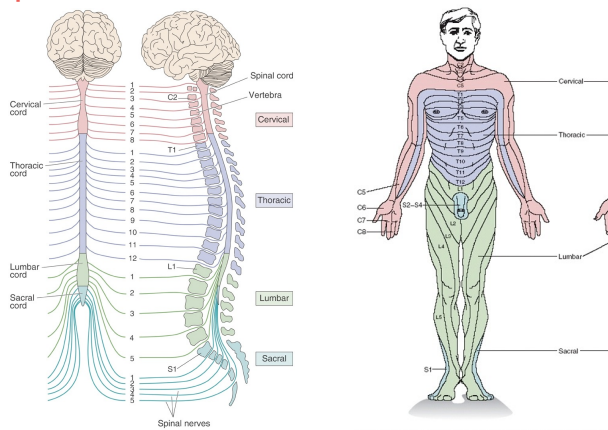
Neural virus have special challenges: cell body may be distant from site of virus entry.

So viral particles need to travel from axon terminals to cell body and back.

Viruses can also jump synapses, often in specific direction (e.g. retrograde or anterograde).



One Spinal Sensory Nerve. for each vertebra: receptive fields of one nerve = dermatome



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Infection by virus that lives in sensory nerve cells: Varicella zoster (shingles or chicken pox)

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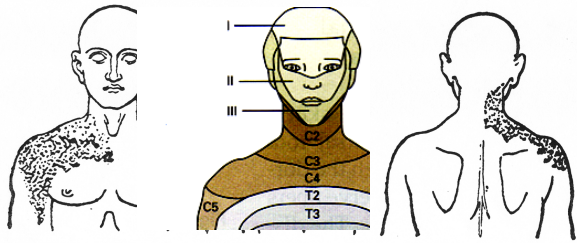
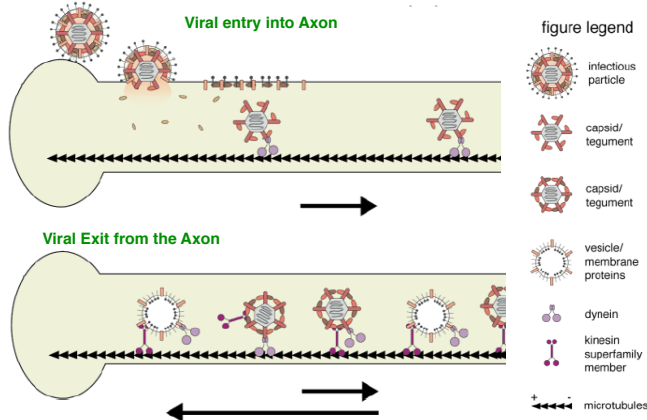


Figure 10.9. Head and Campbell (1900) compared the rashes in individual cases of herpes zoster, like the one shown above, to map the dermatomes in humans.

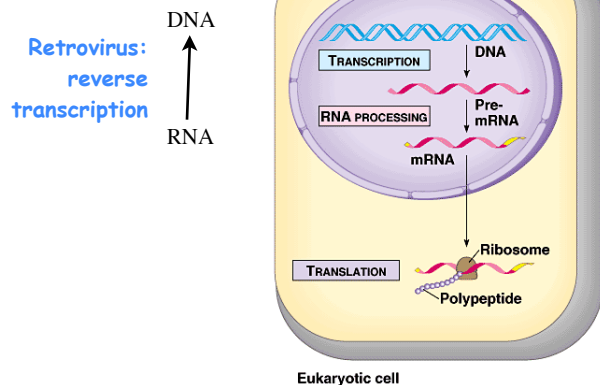
Neuronal Virus: Enters cell, and hijacks cytoskeleton to travel along nerve

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Central Dogma

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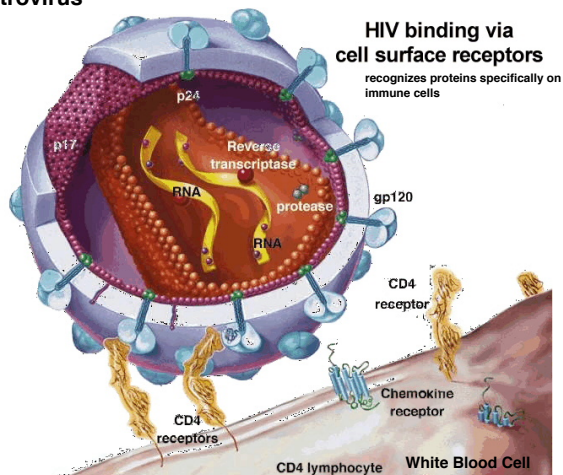


Retrovirus

- RNA genetic information
- use viral Reverse Transcriptase to incorporate DNA copy of viral RNA into host chromosome
- may lie dormant in the host genome for years
- Even if virus is eliminated, infection may reoccur if copy in host genome re-awakens
- if virus infects germ line (i.e. source of sperm and eggs), then virus is passed onto cells of next generation along with host genes
- example: Human immunodeficiency virus (HIV) -> AIDS

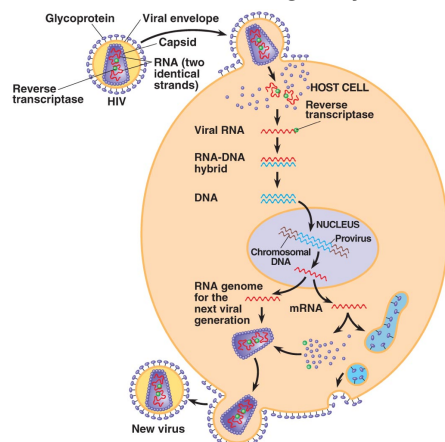
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Retrovirus



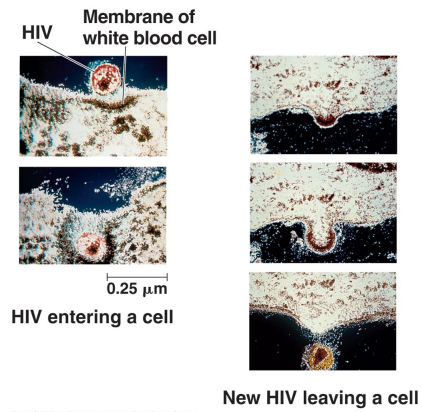
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Retrovirus: violates central dogma by RNA -> DNA



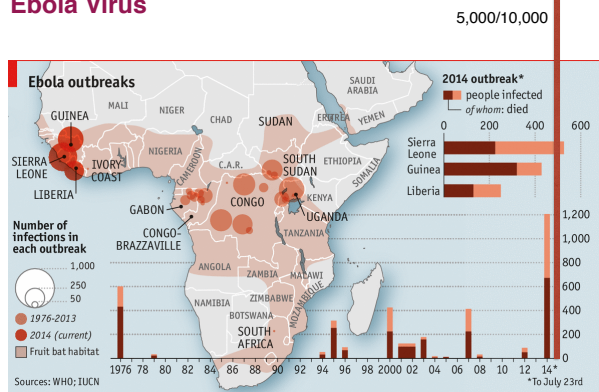
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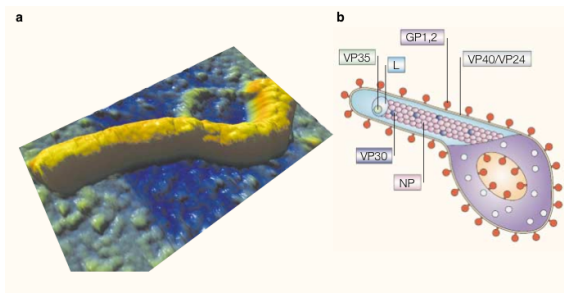
Ebola Virus



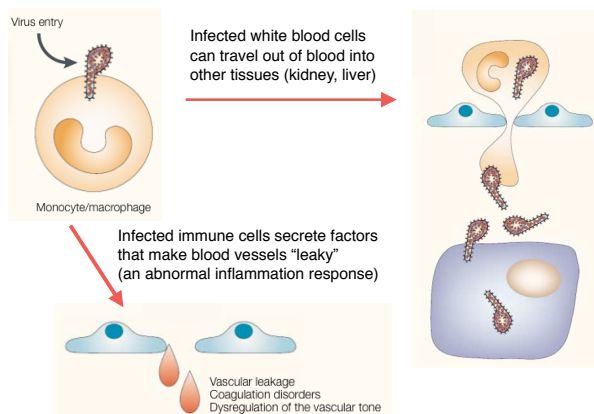
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Ebola Virus

ssRNA, 19000 nt, 7 proteins



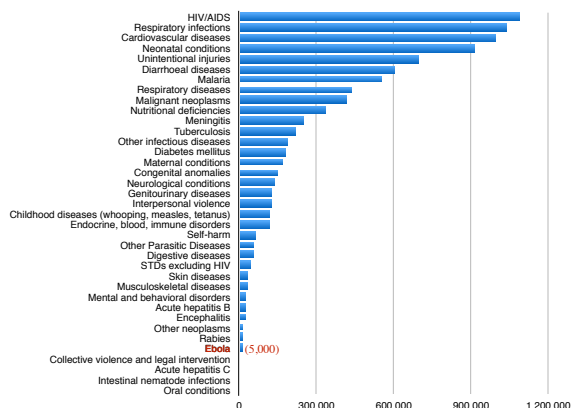
Ebola Virus: infects immune cells, so suppresses immune response



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population: 900 million

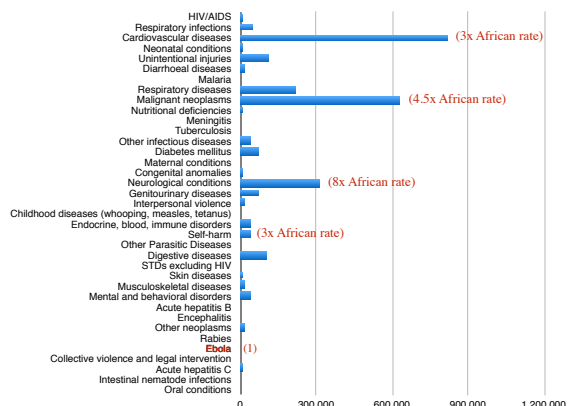
Africa: Causes of Death (2012)



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population: 300 million

USA: Causes of Death 2012



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