Chapter 19: Viruses

The Ebola Virus:

First described in 1976. Several epidemics of this disease since. Mainly in West Africa.

Fatalities have also occurred among healthcare workers because of accidents in labs working with the virus.

Spreads by contact with blood or bodily fluids of an infected person or animal.

Symptoms start 2 days to 3 weeks after contracting the virus (fever, sore throat, pain, vomiting, diarrhea, rash, followed by decreased functioning of liver and kidney, plus bleeding internally and externally.)

Fatality rate is around 65%.

No specific treatment or vaccine exists. Mostly hydration, blood transfusion, and experimental drugs. There is a speculation that terrorists may use Ebola as a biological weapon.

19.1 Structure

19.2 Reproduction

19.3 Pathogens

Viral Evolution

They seem to exist in a gray area between life and biological chemicals ("a kind of borrowed life") No metabolism and no independent reproduction.

If viruses are non-living, they don't really die (They just go inactive).

Yet, they do have a genetic code, so they have some evolutionary connection to the living world.

They can evolve very quickly (to dodge the immune system).

Most biologists believe that viruses origionated from naked bits of cellular nucleic acid.

Plasmids: Small circular DNA molecules that exist independently

Transposons: Chunks of DNA that can move from one location to another in a cell's gnome.

Viruses in Biological Research

They showed evidence that genes are made up of nucleic acids.

Helped us understand the molecular mechanisms of DNA replication.

Helped us learn to manipulate genes and transfer them from one organism to another (agents of gene transfer commonly used in gene therapy).

Figure 19.2

What causes tobacco mosaic disease?

Extracted sap from tobacco plant with tobacco mosaic disease.

Passed sap through a porcelain filter known to trap bacteria.

Rubbed filtered sap on healthy tobacco plants.

Healthy plants became infected.

Viral Reproductive Cycle.

Entry and uncoating

Replication

Transcription and manufacture of capsid proteins

Self-assembly of new virus particles and their exit from the cell

Facilitative: One organism needs its partner to survive, but the other can survive perfectly well on its own.

Obligate: One organism involved.

Figure 19.5

The lytic cycle of a phage T4, a virulent (pathogenic) phage.

Attachment

Entry of phage DNA and degradation of host DNA

Synthesis of viral genomes and proteins

Assembly

Release of new Phages

Cycle takes anywhere from 20-30 minutes.

Lysogenic Cycle: Same as lytic cycle, but only a little piece of DNA is incorporated into the cells regular DNA. The cell does not die, but gets passed on.

Table 19.1

Classes of animal viruses are based on the nature of the viral genome and the presence/absence of a viral envelope.

Emerging Viruses Appear Suddenly

Examples:

HIV (1980's)

Ebola (1976 Central Africa)

West Nile Virus (1999)

SARS (2002 South China)

H1N1 (2009).

Why?

Rapid ability to mutate.

Rapid dissemination.

Rapid spread from animals.

Vaccinations

Vaccine: A material that resembles a virus, meant to prevent the person from getting sick.

The flu vaccine for example is a diluted virus that resembles the flu and is intended to improve the immune system to hopefully avoid the flu.

Viral Diseases in Plants

Thousands of viral diseases in plants destroying agricultural and horticultural crops.

Most viral plant diseases have no cure (yet).

Horizontal Transmission: Infection from an external source of the virus. Most likely when plants have been damaged (to allow entry for the virus).

Vertical Transmission: Plant inherits viral infection from the parent.