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A Brief Encyclopedia on Virology

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Description

Virology is the study of viruses and virus-like agents, including but not limited to their taxonomy, disease causing properties, culture, and genetics. Virology is often considered part of microbiology or pathology. Most biological materials show little contrast to their environment unless they are colored. In light microscopy, contrast can be enhanced through the use of colored spots that selectively absorb certain wavelengths. Electrons in the electron microscope are absorbed very little by biological material and contrast is achieved mainly by scattering electrons. Advances in animal virology have been observed throughout the 20th century, but the greatest advance occurred with the development of tissue culture systems such as those used for poliovirus isolation. This greatly facilitated the detailed study of this active substance and, above all, the development of vaccines against poliovirus. In the next 60 years, diagnostic virology matured as a field with the discovery of new drugs and diseases and the parallel determination of the importance of viruses to our understanding of molecular biology and cancer.

Infectious agent consists of nucleic acid (RNA or DNA), a protein layer (capsid), and, in some cases, a lipid layer. Virions have the full ability to replicate when a susceptible target cell is found. As with other infectious agents that cause human disease, the outcome of the interaction of a particular virus with the human host depends on both pathogenic and host factors. Virus strains within a genus can have different cell tropisms, replication capacities, and cytopathogenic effects. Lymphocytes can use different co-receptors (Ex: chemokine receptors, CCR5 or CXCR4) on the cell surface, can replicate at different levels, and can induce different degrees of cell death. These features have direct clinical correlations for HIV-infected individuals in terms of the rate of CD4 cell decline and progression to clinical AIDS.

On the host side, the type of challenge and the immune status of the host are probably the two most important determinants of the outcome. Depending on the pathogen, the virus enters through the skin, mucous membranes, respiratory tract, gastrointestinal tract, through a transfusion or a transplanted organ, or through mother-to-fetal transmission. Local replication takes place at the vaccination site. Certain pathogens show pathology on the surface of the skin or mucous membrane. Some neurotropic viruses can spread along peripheral nerve pathways to ganglia or the central nervous system.

With other neurotropic agents, the central nervous system is seeded after viremia. Many active ingredients replicate in regional lymph nodes with subsequent viremia and spread to target organs. Some viruses circulate freely in plasma and others are cell-associated. Replication in target organs can lead to local damage and more rounds of viremia. Viruses can cause a chronic and persistent infection with continued replication of the virus despite an immune response. Examples include HIV, hepatitis B virus, and hepatitis C virus.

Some viruses can show persistent infection in immunosuppressed hosts. These include the herpes viruses, the *human papilloma virus*, and the *Rubella virus*. Some viruses can cause a latent infection. Latency is characterized by a transcriptionally inactive or minimally active viral genome with reactivation phases. Latent viruses include herpes viruses (*Cytomegalovirus, Epstein Barr virus, Herpes simplex virus,* and *Varicella zoster virus*), *human papillomavirus*, and *human retrovirus.* Recurrent cold sores or genital herpes due to HSV or herpes zoster due to *Varicella zoster virus* is a classic example of latency and reactivation.

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