Tikrit University

College of Nursing

Basic Nursing Sciences

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Microbiology

Virology part two

By: assistant lecturer

Ayat Munaf Hameed

Virology

(part two)

Viruses can be classified according to the host cell they infect: animal viruses, plant viruses, fungal viruses, and bacteriophages.

- Another classification uses the geometrical shape of their capsid (often a helix or an icosahedron)

- or the virus's structure (e.g. presence or absence of a lipid envelope).

The most useful and most widely used classification system distinguishes viruses according to the type of nucleic acid they use as genetic material and the viral replication method (Baltimore classification) they employ host cells into producing more viruses:

*DNA virsus (divided into double-stranded DNA viruses and single-stranded DNA viruses),

*RNA viruses (divided into positive-sense single-stranded RNA viruses, negative-sense

single-stranded RNA viruses and the much less common double-stranded RNA viruses),

*Reverse transcribing viruses (double-stranded reverse-transcribing DNA viruses and single-stranded reverse-transcribing RNA viruses including retroviruses)

Viral genomes

- The viral nucleic acid is located internally. Single or double strand DNA or Single or double strand RNA

- The nucleic acid can be either linear or circular.

- The DNA is always single molecules

- The RNA exists either as a single molecules or in several pieces

Viral replication

The life cycle of viruses differs greatly between species but there are six basic stages

Attachment: is aspecific binding between viral capsid protein and specific receptors on the host cellular receptors.

Penetration: viruses enter the host cell through receptor- mediated endocytosis or membrane fusion

Uncoating: the viral capsid is degraded by viral enzyme or host enzymes thus releasing the viral genomic nucleic acid

Replecation: involves synthesis of viral messenger RNA (mRNA) for viruses except positive sense RNA viruses

Assemble: viral protein synthesis and assemble of viral protein and viral genome

Release: viruses are released from the host cell by lyses. Enveloped viruses (e,g, HIV) typically are released from the host cell by budding.

Viruses effects on cells

Infection by viruses is usually associated with the following changes in cells:

- Morphologic Effects: The changes in cell morphology caused by infecting virus are called cytopathic effects (CPE). Common examples are rounding of the infected cell, fusion with adjacent cells to form polykaryocytes.

- Effects on Cell Physiology: The interaction of virus with the cell may change the physiological parameters, including movement of ions, formation of

secondary messengers, and activation cascades leading to altered cellular activities.

Effects on Cell Biochemistry: Many viruses inhibit the synthesis of

host cell macromolecules, including DNA, RNA, and protein.

Genotoxic Effects: Following virus infection, breakage, fragmentation, rearrangement and/or changes in the number of chromosomes may occur.

Biologic Effects: Virus-specified proteins may alter the cell's antigenic or immune properties, shape, and growth characteristics.

Prevention and treatment

Because viruses use vital metabolic pathways within host cells to replicate, they are difficult to eliminate without using drugs that cause toxic effects to host cells in general. The most effective medical approaches to viral diseases are vaccinations to provide immunity to infection, and antiviral drugs that selectively interfere with viral replication.

Persistent viral infections

Chronic infection: Refer to peoples who produced viruses long periods of time

and can serve as a source of infection for others (HCV).

Slow infection: Are those infection with a long incubation period e.g. measles.

Latent infection: Common features of latent infection are their ability to reactivated at subsequent time in response to various environmental stimuli (e.g., heat, ultraviolet irradiation), and immune suppression brought on by heterologous virus infection (e.g., HIV) or chemotherapy, often associated with organ transplantation. Common routes of viral infection in human

-Droplet contact (respiratory route) e.g.common cold

-Oral transmission

-Sexual transmission

-Iatrogenic transmission

Transmission due to medical procedures, such as injection or transplantation

of infected material and blood transfusion.

Influenza virus

Three distinct types of influenza virus, dubbed A, B, and C, have been identified.

Most cases of the flu, are caused by the influenza A virus, which can affect a variety of animal species, but the B virus, which normally is only found in humans,

is responsible for many localized outbreaks. The influenza C virus is morphologically and genetically different than the

other two viruses and is generally nonsymptomatic, so is of little medical concern