Viral Protein:

The major purpose of the viral protein is to aid transfer of viral genome. They also protect the viral genome against the action of nucleases of the host cell and participate in the attachment of the virus particle to a susceptible cell during infection. The viral capsid is made up of protein subunits known as capsomers which are made up of capsomeres.

Viral Lipids:

A number of different viruses contain lipid envelopes as part of their structure. The lipids is required when the virus nucleocapsid buds through a cellular membrane during maturation. The phospholipid composition is determined by the specific type of cell membrane in the budding process. The acquisition of lipid containing membrane is an integral step in virion morphogenesis in some virus group.

Nucleic acid:

Viruses contain only a single type of nucleic acid, DNA or RNA that encodes all the genetic information necessary for the replication of the virus. The viral nucleic acid is also referred to as viral genome. The viral genome can be single or double stranded, circular or linear, segmented or linear.

Viral Carbohydrate:

Virus envelope contain glycoproteins.In constrass, to the lipids they are derived from the host cell, the envelope glycoprotein reflect the host cell in which the virus is grown. It is the surface glycoproteins of enveloped viruses that attaches the virus to a target cell by interacting with cellular receptors and also important viral antigen.

SOME KEY TERMS USED IN VIROLOGY

Capsid: The protein shell or coat that encloses the nucleic acid genome (DNA or RNA)

Capsomere: Each capsid is composed of many identical protein sub-unit .It also represent clusters of polypeptides but the morphologic units do not necessarily correspond to the chemically defined structural units.

Nucleocapsid: The viral capsid together with nucleic acid that is tightly packed within the protein coat, or is a term commonly used in cases where the nucleocapsid is a substructure of a more complex virus particle.

Defective virus: A virus particle that is functionally deficient in some aspect of replication.

Eveloped viruses: Many varions that infect human and other animals however, have an additional covering over the capsid protein. This consist of a double layer of lipid similar in structure to the cell membrane of eukaryotic cell. Or a lipid-containing membrane that surrounds some virus particles, which is normally acquired during viral maturation by a budding process through a cellular membrane.

Peplomers: Virus-encoded glycoproteins are exposed on the surface of the envelope. These projections are called peplomers.

Structural units: The basic protein building blocks of the coat. They are usually a collection of more than one non-identical protein subunit.

Protomer: *Are usually a collection of more than one non identical protein subunit. The structural unit is often referred to as a protomer.*

Subunit: *A single folded viral polypeptide chain.*

Bacteriophage: *A virus that infects bacteria, often shortened to phage.*

Burst size: *Number of newly formed virus particles released from a single cell following virus replication.*

Carrier cells: *cell that are capable of releasing virus particles without being killed by the virus.*

Non enveloped virus: *A virus that lacks an envelope, also called a naked virus.*

SOME KEY TERMS USED IN VIROLOGY

Latent State: The state of a phage when its DNA is integrated in to the genome of the host.

Lysogen: A bacterium that carries phage DNA (the prophage) integrated in to its genome.

Lysogenic Conversion: The change in properties of a bacterium as a result of carrying a prophage. The phage DNA codes for new properties.

Maturation: The stage in a viral replication in which the various compartments of the virion assemble to form a whole virion.

Productive infection: Viral infection in which more virus particles are produced as a result of infection.

Prophage: Phage DNA that is integrated in the genome of a host.

Temperate phage: A phage that has the ability to integrate its DNA in to the chromosome of host.

Attachment protein or spikes: All bacterial and animal viruses but not plants viruses must be able to attach (adsorb) to specific receptor site on the host cell. In tallest isomeric viruses attachment proteins or spikes project from the capsid and are involved in attaching the virus to the host cells, while in isomeric viruses with tails (sheaths), tail fibres serve to attach the virus to the host cell.

Virus: An infectious agents having a simple acellular organization, often just a protein coated and a nucleic acid genome; lacking independent metabolism; and reproducing only within living host cells.

Virusoid: An infectious agents composed of only of RNA; its RNA encodes one or more proteins but it can only replicate in cell also infected by a virus.

Virion:

The complete virus particle, in some instance e.g.(Papilloma viruses, Picorna viruses) the virion is identical with nucleocapsid. In more complex virion(herpes viruses,. Orthomyxo viruses) this includes the nucleocapsid plus a surrounding envelope. A virus in its inert extracellular form. Its serve to transfer the viral nucleic acid from one cell to another.

Virulent Viruses: Viruses that lyse their host cells during the multiplication cycle.

GENERAL CLASSIFICATION SYSTEM FOR VIRUSES{TAXONOMY}

Classification is the description of the diversity by naming and grouping based on similarities. There are five classification system for viruses in some text, namely;

1- LHT System of classification (A.Lwoff, R. Home and P. Tournier). A proposed system of classification of viruses in (1962), which is commonly referred to as LHT system of classification. It was adopted by the provisional Committee on Nomenclature of viruses (PNCV) formed by the International Association of Microbiology Society.

The LHT system of classification is based on (a) the nature of nucleic acid, (DNA or RNA). (b) symmetry or viral particle (helical, icosahedral, cube, cubic-tailed). (c) presence or absence of envelope, (d) diameter of capsid and (e) number of capsomers forming the capsid.

2- Casjens and King's System of Classification: Casjens and King's in (1975) Classified the viruses on the basis of nucleic acid type, symmetry presence or absence of the envelope and site of assembly of the envelope i.e. nuclear and cytoplasmic.

Generally, the last three (3) main system of classification are the most widely used and accepteds. These includes:

3- Baltimore system of classification

4- Holmes system of Classification

5- ICTV System of classification (International Committee on Taxonomy of Viruses)

FACTORS TO BE CONSIDERED IN CLASSIFICATION OF VIRUSES

Viruses are classified in to related groups or families and sometimes in to subfamilies based on:

(I)-Types and structure of the viral nucleic acid.(DNA or RNA / Single or double stranded)

(ii)-The strategy used in its replication

(iii)- Types of symmetry of the virus capsid (helical versus Icosahedral).

(iv)- Presence or absence of lipid envelope.

(v)- Host tissue range and cell tropism.

(vi)- Serological reaction (Immunologicalproperties).

(vii)- Amino acid sequences of viral protein.

(viii)- Degree of nucleic acid homology.

Are among others, form the basis for division in to genera (singular genus) and species.

Species of the same virus isolated from different geographic locations may differ from each other in nucleotide sequence, in this case, they are referred to as strain of the same specie for example:

Family – Varidae e.g. Heresviridae.

Subfamily- verinae e.g. Alphaherpesvarinae.

Genus- virus e.g. Herpes virus

Specie- Herpes simplex virus.

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3- Baltimore system of classification

Developed by a Nobel prize- wining biologist David Baltimore (2008), is based on the mechanism of mRNA production. Viruses must generate mRNA from their genome to produce protein and replicate themselves, but different mechanism are used to achieve this in each virus family. Viral genome may be single-stranded(ss) or double-stranded(ds), RNA or DNA and may or may not use reverse transcriptase. In addition, ssRNA viruses may be either (+)sense or (-)antisense: He classified viruses in to seven classes.

Group 1- Double-stranded DNA viruses {dsDNA Viruses }. e.g. Adenoviruses, Herpesviruses, Poxviruses.

Group II- Sense single- stranded DNA{ (+) sense ss DNA Viruses}. e.g. Parvoviruses

Group III- Double-stranded RNA Viruses {dsRNA Viruses} e.g. Reoviruses

Group IV- Sense single- stranded RNA { (+) sense ss RNA Viruses} e.g. Picornaviruses, Togaviruses.

Group V- No-sense single stranded RNA Viruses. { (-) sense ssRNA Viruses} e.g. Orthomyxoviruses, Rhabdoviruses.

Group VI- Sense single stranded RNA reverse transcriptase { (+) Sense ssRNA-RT Viruses, RNA with DNA intermediate in life cycle} e.g. Retroviruses.

Group VII- Double stranded DNA reverse transcriptase {dsDNA-RT Viruses} e.g. Hepadnaviruses.

4- Holmes system of classification

I

dsDNA

4- Holmes system of classification

Holmes in 1948 used Carolus Linnacus system of Binomials nomenclature classification system to group viruses in three (3) groups under one order Virales:

Group I: Phaginae (attacks bacteria)

Group II: Phatophaginae (attacks Plants)

Group III: Zoophaginae (attacks Animals

5- ICTV System of Classification

Developed by the international committee on taxonomy of viruses (ICTV) since 1966. The general taxonomic structure is as fallows:

Order: Virales

Family: Viridae

Subfamily: Varinae

Genus: Virus

Specie: Virus

In ICTV taxonomy five orders have been established namely:

-Caudovirales

-Herpesvirales

-Mononegavirales

-Nidovirales

- Picornavirales

VIRAL REPLICATION CYCLES

ONE-STEP GROWTH CURVE

The one-step growth curve is a representation of the overall change, with time, in the amount of infectious virus in a single cell that has been infected by a single virus particle. This is determined by the following events in a large population of infected cells in which the infection is proceeding as nearly synchronously as can be achieved by manipulating the experimental conditions. Whereas the time scale and yield of progeny virus very greatly among virus families, the basic features of the infectious cycle are similar to all viruses. The one-step growth curve begins with the eclipse period, which is followed by a period of exponential growth.

Eclipse period (Lytic cycle)= Following initial attachment of a virus to the host cell, the ability of that virus to infect other cells disappears. This is the eclipse period, and it represents the time elapsed from initial entry and disassembly of the parental virus to the assembly of the first progeny virion. During this period, active synthesis of virus components is occurring . The eclipse period for most human viruses falls within a range of1 to 20 hours.

Exponential growth (Lysogenic cycle)= The number of progeny virus produced within the infected cell increases exponentially for a period of time, then reaches a plateau, after which no additional increase in virus yield occurs. The maximum yield per cell is characteristic for each virus-cell system and reflects the balance between the rate at which virus components continue to be synthesized and assembled in to varion, and the rate at which the cell loses the synthetic capacity and structural integrity needed to produce new virus particles. This may be from 8 to 72 hours or longer, with yields of 100 to 10000 virions per cell.