**Lecture: *Introduction to medical virology.***

**By ;**  **Dr.Malak El-Hazmi .**

**Dr. Mohammad Arif .**

**OBJECTIVES**

**By the end of this lecture, the student is expected to be able to:**

1. Distinguish the viruses from other microorganisms .
2. Know the essential characteristics of viruses**.**
3. Describe the structure of virus.
4. Identify someviruses using the electron micrograph based on their characteristic structural features.
5. Know the classification of viruses.
6. Describe the general steps of virus replication.
7. Know different laboratory methods used to diagnose the viral infections.

**BACK GROUND:-**

The other infectious agents namely, bacteria, fungi, protozoa and worms are either single cells or composed of many cells. Cells are capable of independent replication, can synthesize their own energy and proteins, and can be seen in the light microscope. In contrast, viruses are not cells, they are not capable of independent replication, can synthesize neither their energy nor their own proteins ,and are too small to be seen in the light microscope.

Viruses replicate in a manner different from that of cells. The understanding of viral replication brought practical benefits in the form of anti viral drugs.

There are several approaches to diagnose viral diseases by the use of clinical specimens.

**KEY PRINCIPLES TO BE DISCUSSED**

***The different terms mentioned here will be defined & discussed;***

* **The virus is a unique infectious agent**. The virus is not a cell. It is an obligate intercellular parasite . It is a tiny particle, composed of an internal core containing either **DNA or RNA** but not both, surrounded by a protein coat ,called a **capsid**. In some viruses ,the capsid is covered by a lipoprotein mb , called an **envelope**.
* There are 3 forms of viral **symmetry** [**Icosahedral**, **helical**, & **complex**].
* The appearance of viruses in the electron microscope examination.
* **The classification of viruses** is based primarily on ;

1-the nature of the genome (RNA/DNA, number of strands[ ss /ds], and the polarity of viral genome;[negative/positive strand])

2-the type of symmetry of the viral capsid (helical, Icosahedral or complex )

3- the presence or absence of an envelope.

* **The viral replication** starts with attachment (**adsorption**) of the virus to specific receptor on the surface of the host cell. Then the virus penetrate the host cell by two main mechanisms ( **fusion** and **endocytosis**).

Following the adsorption and penetration, the virus genome is **uncoated** by removing the capsid protein, so the genome is free to function to synthesis of viral components, this is by the formation of mRNA which is translated in to structural & non-structural proteins, and formation of viral genomes.

The new viral genomes and proteins are **assembled** to form new virus particles then the virions are released from the cell.

The release of virus particles is either through cell lysis or through **budding**.

* **LAB DIAGNOSIS**

There are five approaches to the diagnosis of viral diseases by the use of clinical specimens.

* Microscopic Examination;

**Electron microscopy** detects virus particles, which can be characterized by their size and morphology.

**Light microscopy** can reveal characteristic inclusion bodies or multinucleated giant cells.

* Isolation and identification of the virus in **cell culture**;

Virus growth in cell culture frequently produces a characteristic cytopathic effect that can provide a presumptive identification.

A definitive identification is made by using known antibody .

* **Serological test;**

The presence of IgM is used to diagnose current infection.

* **Detection of viral Antigens** ;

The presence of viral protein such as hepatitis B surface antigen is commonly used in diagnosis.

* **Detection of Nucleic acids** ;

The presence of viral DNA or RNA is increasingly becoming the "gold standard" in viral diagnosis.

**TAKE HOME MESSAGES**

1. The viruses differ from other infectious agents in being of tiny particles (not cells) seen by EM and they are obligate intracellular parasites.

2. Viruses contain either DNA or RNA but not both. All viruses have a capsid .some viruses have an envelope.

3. The DNA or RNA genome can be either single-standard or double-standard. Some viruses have a segmented genome.

4. Viral proteins (surface or internal) have different functions.

5-. Only six families are DNA viruses. Others are RNA viruses.

6. All human viruses that have a helical capsid are enveloped and having RNA genome.

7. Viruses that have an icosahedral nucleocapsid can be either enveloped or naked. Naked are usually more resistant than enveloped viruses, and usually transmitted by fecal-oral route.

8. Steps of virus replication ;

adsorption, penetration (fusion, endocytosis ), uncoating , synthesis of viral mRNA, synthesis of proteins and genome, assembly, release (budding, lysis of cells)

9. It is important to know different methods of laboratory diagnosis of viral diseases, such as ELISA which can be used for detection of specific IgM, IgG or viral antigen.

**ADDITIONAL READING**

1- Medical Microbiology and Immunology

By: Warren Levinson .

10th Edition, 2008.

Published By: McGraw-Hill Co.

2- Lippincott’s Illustrated Reviews: Microbiology

By: Richard A.Harvey ,

Pamela C Champe &

Bruce D. Fisher

2nd Edition, 2007 .

Published By: Lippincott Williams and Wilkins.