



MICROBIOLOGY

Introduction to medical virology



" Lecture 3 "

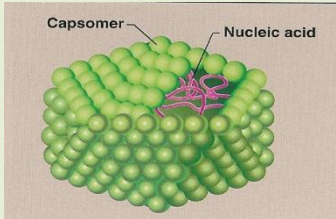
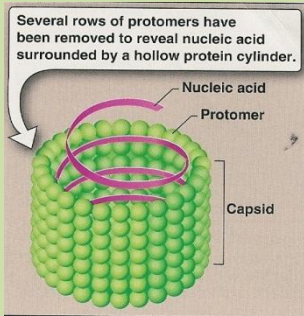
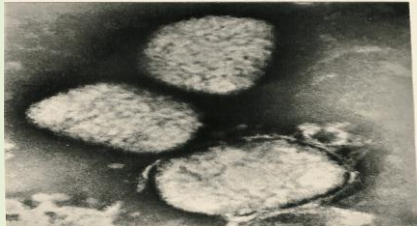
Done by: رakan المطيري

OBJECTIVES:

- *General characteristics of viruses.*
- *Structure & symmetry of viruses.*
- *Classification of viruses.*
- *Steps of virus replication.*
- *laboratory diagnosis of viral infections*

Viruses : Are the smallest parasites, they can't replicate by their own, they have to invade a living HOST cell, and take over its machinery in order to be able to make more virus particles, but why ? Cause they don't have Ribosomes and Mitochondria. Also, 1 Virus Replicate into millions. Damn ^^

<u>Viral Structure</u>	<u>Components</u>	<u>More Info</u>
1-Viral genome	<p>DNA All DNA Vs have double strand except Parvoviruses.</p> <p>RNA (Ribonucleic acid) All RNA Vs have single strand except Reoviruses</p>	<p>RNAs Polarity: + : Viral genome Directly Produce Protein. - : Viral Genome Indirectly Produce Protein.</p> <p>All Vs are haploid ,except retroviruses are diploid</p>
2-Capsid	<p>a protein coat Subunits (capsomeres) Genome (NA) + capsid= nucleocapsid</p>	<p>The basic Subunit of the Capsid is the Capsomere. Who control the shape of the Virus are the Capsomeres.</p> <p>Function:</p> <ul style="list-style-type: none"> • Protects NA • Facilitates its entry into cell
3-Envelope	<p>Lipoprotein membrane (host lipid, virus specific protein)</p>	<p>During viral budding Envelope is derived from cell membrane except herpes viruses from nuclear membrane. Enveloped Viruses are more sensitive to heat ,dry & ether than non-enveloped viruse. Glycoprotein attaches to host cell receptor.</p>

Symmetry (Shape of the Virus) based on arrangement of capsomeres		
SHAPE	EXAMPLE	PICTURE
Cubic symmetry (Icosahederal)	1\ Adenovirus 2\ Herpesvirus	
Helical symmetry	1\Elongated (filoviruses 2\Pleomorphic (influenza v.)	<p>Several rows of protomers have been removed to reveal nucleic acid surrounded by a hollow protein cylinder.</p> 
Complex symmetry	1\ poxviruses	

Viral proteins	
The outer viral Proteins	Mediate attachment to specific Rs Induce neutralizing Abs Target of Abs
The internal viral Proteins	Structural ps (capsid ps of enveloped Vs) Nonstructural ps (enzymes) <ul style="list-style-type: none"> All ssRNA Vs (-) polarity have transcriptase (RNA dependent RNA polymerase) inside virions RetroVs & HBV contain reverse transcriptase

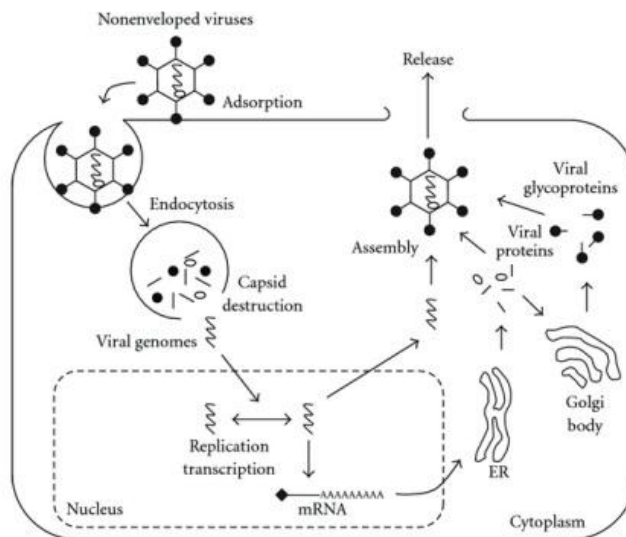
Classification of viruses:

- Type of NA (DNA,RNA) نوع الحمض النووي
- The number of strand (double, single)
- The polarity of viral genome (positive, negative) القطبية
- The presence or absence of envelope وجود او غياب الغلاف
- Type of symmetry (helical, complex, cubic) نوع تناظر او شكل الفيروس

Medically Important Viruses: ذكر الدكتور أنه ليس مهم حفظها وإنما المهم معرفة تصنيف الفيروسات

Replication of Viruses	
Adsorption (Attachment)	Glycoprotein help the Virus to Attach
Penetration اختراق	* Fusion: Virus have a membrane and they will fuse and the Virus will Enter. * Endocytosis: Virus is consumed by the Cell. Cell wraps around the Virus.
Uncoating	Release of Viral Genome to Cytoplasm in Direct Synthesize of Protein or to Nucleus in indirect Synthesize of protein.
Synthesis of viral components	mRNA: This Step for (-) RNAs Viruses, it will use the genome to produce mRNA, and that's why it is indirect Viral proteins: This Step for (+) RNAs, they have mRNA, it will begin the synthesize by the Ribosomes Directly . Replication of viral genome: The mechanism will continue for the replication, As we said, one virus will produce in one cell millions of viruses.
Assembly تركيب او تجميع	NA + V. proteins = Virions [Virus particles]
Release	Enveloped Viruses: Virus leaves the Cell and create his Envelope from the cell membrane by the help of GlycoProtein ex: herpes Vs. nonEnveloped Viruses: Cell lysis or rupture

illustrating Picture:



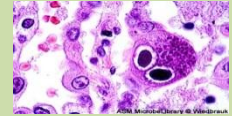
laboratory diagnosis of viral infections: التشخيص المختبري للالتهابات الفيروسية

Microscopic examination

Light microscopy

Histological appearance (to see what the virus has done to the cell, **without** seeing the virus itself)

Ex. Inclusion bodies (it is usually a protein substance that represents the site of viral multiplication)



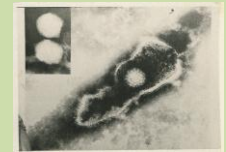
Electron microscopy

Morphology & size of virions (to see the virus particle itself)

Ex. Diagnosis of viral GE (gastro-enteritis) such as rota, adenoviruses.

Diagnosis of skin lesion caused by herpes, or poxviruses.

It is replaced by Ag detection & molecular test s



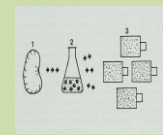
Cell Culture

No of sub passages
(the number of times the cells have been subcultured)

illustrating Pictures

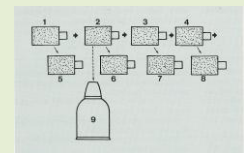
Primary c/c

1 to 2



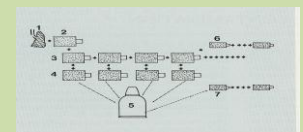
Diploid c/c

20 to 50



Continuous cell line

Indefinite



Detection of viral growth

Cytopathic effects:

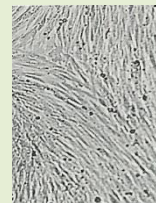
Rounding, shrinkage, aggregation, and loss of adherence.

Giant Cell formation.

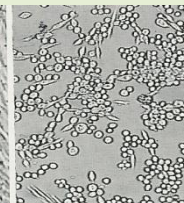
Inclusion bodies formation: The site of viral replication and protein synthesis.

Immunofluorescence

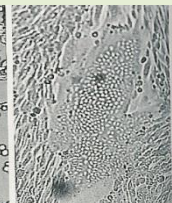
Other..



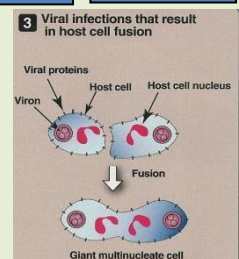
Uninfected cc



Cell rounding



Syncytium



Cell culture

Problems with cell culture

Long incubation (up to 5 days).

Sensitivity is variable.

Susceptible to bacterial contamination.

Some viruses do not grow in cell culture e.g. **HCV**.

Because one of the problems with cell culture is long incubation, they came up with a modified cell culture: a **Rapid culture technique**:

Shell vial assay (this technique detects viral antigens in **cell culture**, and takes 1-3 days)

<u>Serological tests</u>	<u>Antigen detection</u>			<u>Antibody detection</u>
	<u>sample</u>	<u>virus</u>	<u>test</u>	e.g. of techniques
	Nasopharyngeal aspirate	Influenza V	IF	Complement fixation test (CFT)
	Skin scrapings	HSV	IF	Immunofluorescence (IF)
	Faeces	Rotavirus	ELISA	Enzyme-linked immunosorbent assay (ELISA)
	Blood	HBV(HBsAg)	ELISA	
	Immunofluorescence (IF)		Enzyme-linked immunosorbent assay (ELISA)	
	Direct: antigen detection by using an antigen sample Indirect: antibody detection by using an antibody sample Uses florescent dye		Direct: antigen detection or specific IgM,IgG Indirect: antibody detection, Uses an enzyme that reacts with an enzymatic substrate to show colour, coloured wells indicate reactivity.	
<u>Molecular method</u>	Polymerase chain reaction (PCR): NA amplification technique. Viral genome Uses; Diagnosis Monitoring response to treatment			

In Viral proteins we have mentioned **transcriptase** and **reverse transcriptase**

Reverse Transcriptase: It's an Enzyme that change the RNA to DNA, this mechanism is needed for retroviruses family, like HIV virus.

هذا فيديو يوضح عمل فيروس وكيفية يحصل التحويل من ٤٠-١:٢٠ ولكن انصحكم تشوفون الفيديو كامل عشان تاخذون فكره اكبر عن عمل الفيروس بدلا من أخذ معلومات مكسرة: <http://www.youtube.com/watch?v=eS1GODinO8w>

Transcriptase: An Enzyme that transfer the RNA genome to mRNA in (-) polarity RNAs viruses.

Cell Culture:

هو زراعة الخلايا داخل وعاء ومن ثم تتكاثر الخلايا داخل الوعاء حتى يمتلئ هذا الوعاء ونزرعه في وعاء آخر حتى يمتلئ ونأخذ جزء ونزرعه حتى يمتلئ، طيب ليه نسوي هالعملية ؟ خلونا نرجع للوراء شوي، اول مره زرعنا فيها الخلايا كانت الخلايا جديده، طيب نتقدم شوي، يوم كررنا العمليات عدة مرات اصبحت الخلايا قديمه، هنا بنقول انه فيه فيروسات بيبتها في خلايا جديده وفيه فيروسات بيبتها في خلايا قديمه؛ لان الخلايا الجديده ليست بنفس الخلايا القديمه بسبب التغيرات اللي تحصل بها.

Notes: from 431

deference between cell culture and serological tests:

- cell culture: cytopathic effects (CPE)
- serological tests: detects antigen or antibody

deference between shell vial assay and IF:

- shell vial assay: detects viral antigen in cell culture
- IF: detects viral antigen in sample
- There is no helical capsid in DNA group

هندي فيديوهات لتي بيبي يطلع او عنده شيء ناقص بيبي يفهمه

<http://www.youtube.com/watch?v=Rpj0emEGShQ>

<http://www.youtube.com/watch?v=uwiPidO7K2s>

<http://www.khanacademy.org/science/biology/tree-of-life/v/viruses>

السلايدات كثيره فوق ٤٠ .. انصح المذاكره من هذا الملف لأنه تم شمل المحاضره كامله .. إن رأيتم خطأ بالملف اتمنى مراسلة قائد المايكرو .. تم تلخيص المحاضره من سلايدات الطلاب !

بالتوفيق،،