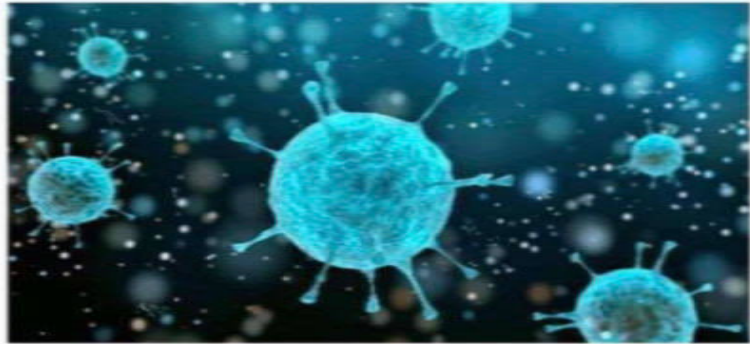


Lecture 5



MICROBIOLOGY

Second Year
Passion Batch

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Acellular Microbes



Viruses

infectious parasite

is not an organism

very small

cannot replicate by itself (uses the genetic machinery of host cell)

- Viruses are extremely small.
- They are observed using electron microscopes
- Viruses are not alive
when the number of virus increases in a host cell, they make pores in the host cell or do something like budding (invasion of the cell edge)
هاي اشكال ظهور الفيروس
- To replicate, viruses must invade live host cells.

- Viruses infect humans, animals, plants, fungi, protozoa, algae, and bacterial cells **also arthropods(all living organisms)**
- Many human diseases are caused by viruses
- Oncogenic viruses or oncoviruses—cause specific types of cancer, including human cancers such as lymphomas, carcinomas, and some types of leukemia.

oncology:is the study of cancer

much of the cancer is generally related to viruses

***lymphoma:is a group of blood cancers that develop from lymphocytes (it starts in WBCs)
 leukemia is a group of blood cancers that begin in the bone marrow and result in high number of abnormal blood cells
 carcinoma:is a type of cancer in the cells that makeup the skin or the tissue Lining organs **
 (للعلم فقط من جوجل)

Viruses have five specific properties

- The vast majority of viruses possess either DNA or RNA
depending on the nucleic acid (ما بتلاقى فايروس عنده الاثنان مع بعض)
- They are unable to replicate (multiply) on their own
- They do not divide by binary fission, mitosis, or meiosis.
- They lack the genes and enzymes necessary for energy production.
- They depend on the ribosomes, enzymes, and metabolites (“building blocks”) of the host cell for protein and nucleic acid production.

Viruses classification



according to the nucleic acid it has

- type of genetic material (either DNA or RNA)
- shape of the capsid
- number of capsomeres
- size of the capsid
- presence or absence of an envelope —doesn't have coat
- type of host that it infects
- type of disease it produces
- target cell
- immunologic or antigenic properties.

capsid:is the protein shell of virus
capsomeres:protein layer
*** (building block of capsid)***

✓ if it can undergo budding or not (تتبرعم)

Bacteriophages

وهي قاعدة الفيروس من شره حتى البكتيريا لحقها منه
ضرر



- The viruses that infect bacteria are known as bacteriophages

if the virus infect bacteria then the structure is bacteriophage

- They are obligate intracellular pathogens, in that they must enter a cell to replicate

bacteriophage classification:

a) virulent phages: when the virus enters the host cell it initiates cell lysis causing damage to the host cell

b) temperate phages: virus that infects bacteria and doesn't initiate cell lysis

temperate BP: هذا الفيروس بصير له

integration in the genetic material of the bacteria (in the chromosome)

whatever the virus genetic content is (either DNA or RNA) it will be integrated with the chromosome of the bacterial cell, results in addition of genetic traits to the bacterial cell from the virus genetic material

(بزيدي بجينات البكتيريا من الفيروس)

- Bacteriophages can be categorized by the type of **nucleic acid** that they possess
- Bacteriophages can be categorized by the events that occur after invasion of the bacterial cell
- Some are virulent phages, whereas others are temperate phages

temperate is the virus that infects bacteria and doesn't cause cell lysis (its effect is to add genetic traits)

virulent affect host cells and cause cell lysis (it damages host cell)

Virulent bacteriophages



- Once it enters a host cell, a virulent bacteriophage always initiates the lytic cycle, which results in the destruction of the cell.
- Bacteriophages can only attach to bacteria that possess surface molecules (receptors) that can be recognized by molecules on the phage surface.

there are four methods of transporting genetic information in bacteria

:conjugation,transformation,transduction,lysogeny

bacteriophage(virus) uses two of these processes:lysogeny and transduction

some bacterial cells(corynebacterium diphtheriae=causes diphtheria disease,normally it is not pathogenic"doesn't have a toxic gene"but if infected with a virus has a toxic gene >>this virus will transfer the genetic material by lysogeny to the chromosome of carynebacterium diphtheria and this transforms the bacteria into toxogenic bacteria

conclusion:not toxogenix bacteria_>_infected by virus_>_toxogenic bacteria it becomes

Steps of lytic cycle

1. Attachment **there must be receptors for the virus to enter the host cell and the receptors are specific for this virus (without the receptors virus won't be able to attach to the host cells)**
2. Penetration
3. Biosynthesis **virus will start using the genetic machinery of the host cell ,then starting the replication process >increasing their number till cell bulge >cell burst**
4. Assembly
5. Release

Temperate phages (lysogenic phages)

البيكتيريا ما يستفيد من الفايروس هون غير باضافة بعض benefit: المواصفات الجينية

- Temperate bacteriophages do not immediately initiate the lytic cycle. Their DNA can remain integrated into the host cell's chromosome for generation after generation.
- Bacteriophages are involved in two of the four major ways in which bacteria acquire new genetic information.

وسائل انتقال المادة الوراثية four processes: transduction, conjugation, transformation, lysogeny

- These processes— called lysogenic conversion and transduction

Animal Viruses



- Viruses that infect humans and animals
- Animal viruses can only attach to and invade cells bearing appropriate surface receptors.
- Animal viruses escape from their host cells by either lysis of the cell or budding.
- Viruses that escape by budding become enveloped viruses.

| Step | Name of Step | What Occurs During This Step |
|------|-------------------------|---|
| 1 | Attachment (adsorption) | The virus attaches to a protein or polysaccharide molecule (receptor) on the surface of a host cell |
| 2 | Penetration | The entire virus enters the host cell, in some cases because it was phagocytized by the cell |
| 3 | Uncoating | The viral nucleic acid escapes from the capsid |
| 4 | Biosynthesis | Viral genes are expressed, resulting in the production of pieces or parts of viruses (i.e., viral DNA and viral proteins) |
| 5 | Assembly | The viral pieces or parts are assembled to create complete virions |
| 6 | Release | The complete virions escape from the host cell by lysis or budding |

- Inclusion bodies, are often seen in infected cells and are used as a diagnostic tool to identify certain viral diseases
- Inclusion bodies may be found in the cytoplasm (cytoplasmic inclusion bodies) or within the nucleus (intranuclear inclusion bodies), depending on the particular disease.
- In rabies, the cytoplasmic inclusion bodies in nerve cells are called Negri bodies

diagnosis of the virus in the tissues depending on the inclusion bodies
some of the inclusion bodies are seen in histopathology(how?)if we took biopsy from the patient
then we will see inside neurons some of the inclusion bodies (this is what we call diagnosis تعرف
(تشوف الاشياء اللمية)
each virus has its own specific inclusion body



in rabies patient

Purkinje cell - Negri body

inclusion body: are nuclear or cytoplasmic aggregates of stable substances, usually proteins. They typically represent sites of viral multiplication in a bacterium or a eukaryotic cell and usually consist of viral capsid proteins. (زيادة)

Latent Virus Infections

- In Herpes virus infections although the infected person is always harboring the virus in nerve cells, the cold sores come and go

latent and active forms of any virus depends on the immune status of the patient
viruses mostly depend in their action on the immune system

- Latent viral infections are usually limited by the defense systems of the human body

many viruses cannot transform from the latent form to the active form depending on the immune status of the patient > if your immune system is strong enough viruses cannot do anything > viruses become suppressed but they still exist without signs and symptoms on patients

this is what we call latent viral infection (viruses are still latent and hiding until the immune system is repressed)
in case of herpes virus the ulcers appear again (when ImmuneS is weak)

there is no final treatment for herpes virus : only a localized treatment to reduce the ulcers (drug acts on ulcers not the virus)

Antiviral Agents



- Chemicals have been developed to interfere with virus-specific enzymes and virus production by either disrupting critical phases in viral cycles or inhibiting the synthesis of viral DNA, RNA, or proteins
- Antibiotics are not effective against viral infections.

لا يجوز استخدام مضاد حيوي لعلاج إصابة فيروسية (محرّم)
what antibiotics make in case prescribed for a patient with viral infection is that they kill the normal flora in the body and develop bacterial resistance against antibiotics which is very dangerous