Microbiology

بسم الله الرحمن الرحيم

List of enveloped virus families and the origin of the envelope

Virus family[a]	Membrane
Arenaviridae	Plasma membrane
Arterivirus	Endoplasmic reticulum
Asfarviridae	Endoplasmic reticulum and plasma membrane
Baculoviridae	Plasma membrane
Bunyaviridae[b]	Golgi complex
Coronaviridae	ER Golgi intermediate compartment
Cystoviridae[c]	Plasma membrane
Deltavirus	Endoplasmic reticulum
Flaviviridae	Endoplasmic reticulum
Fuselloviridae[d]	Plasma membrane
Hepadnaviridae	Endoplasmic reticulum
Herpesviridae	Nuclear envelope
Poxviridae	ER Golgi intermediate compartment

Toga virus. ER

Herpesvirus nucleocapsids are unique in virology because their nucleocapsids bud through the inner .nuclear membrane (INM) to obtain a virion envelope

Viruses that acquire their envelope from ER as far as I know are flaviviridae
(e.g., dengue virus, West Nile virus, zika virus and hepatitis C virus),
coronaviridae (SARS and MERS) and hepadnaviridae (hepatitis B virus).

Togaviruses, which belong to the family Togaviridae, include viruses such as Rubella virus and Alphaviruses

. **Of the more than 100 known herpesviruses, 8 routinely infect only humans:

Human herpesvirus 1	Herpes simplex virus 1
Human herpesvirus 2	Herpes simplex virus 2
Human herpesvirus 3	Varicella-zoster virus
Human herpesvirus 4	Epstein–Barr virus
Human herpesvirus 5	Human cytomegalovirus
Human herpesvirus 6	HHV-6 variant A or B
Human herpesvirus 7	HHV-7
Human herpesvirus 8	Kaposi's sarcoma-associated herpesvirus

هاي من السلايدات

- **The site of assembly depends on the site of replication within the cell and on the mechanism by which the virus is eventually released**

– in (picornaviruses Examples include Enteroviruses e.g., poliovirus, coxsackievirus, and rhinovirus), (Orthomyxoviruses: Examples include Influenza A, B, and C viruses) , (Rhabdoviruses: Examples include Rabies virus) , (Flaviviruses Examples include Zika virus, Dengue virus, and West Nile virus) , poxviruses and reoviruses assembly occurs in the cytoplasm

– in adenoviruses, polyomaviruses ,herpesvirus (HSV &VZU) and parvoviruses it occurs in the nucleus

Cytopathic effects : changes that occur on the target cell as a result of viral infection
virus-induced damage to cells So once the virus enter the cell it will control the cell to its own benefit

- **Virokines and viroreceptors**: DNA viruses; cell proliferate and avoid host defense

The cytopathic effect (CPE) of a virus refers to the observable changes or damage that a virus induces in host cells during the course of infection.

"Virokines" is a term used to describe viral proteins that mimic or interfere with the functions of cytokines, which are signaling proteins involved in the immune response. These viral proteins are produced by certain viruses as a strategy to modulate the host immune system in ways that benefit the virus.

Virokines typically share structural and functional similarities with host cytokines, allowing them to interact with host cell receptors and manipulate immune responses. By interfering with the normal signaling pathways of cytokines, virokines can dampen the host's antiviral defenses, promote viral replication, and establish a more favorable environment for the virus to thrive.

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One example of a virokine is the human cytomegalovirus (HCMV) protein known as UL144, which exhibits functional similarity to the host cytokine TNF-related apoptosis-inducing ligand (TRAIL). UL144 can modulate immune responses and contribute to the evasion of host defenses by the virus.
Tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) is a potential anticancer drug that selectively induces apoptosis in a variety of cancer cells by interacting with death receptors DR4 and DR5

بالنسبة لل virokines هي عبارة عن بروتينات ال code تبعها من قبل الفايروس وبجبر الخليه اثناء تواجده فيها على
انتاج هاي البروتينات واخر مقطع فيها kines لانها تشبه ال cytokines التي يفرزها الجسم ولها دور مهم في تنشيط
وتثبيط جهاز المناعة
شو الهدف من افرازها الهدف هو تعديل عمل جهاز المناعة وتثبيط الاستجابه ضد الفايروس بالتالي لن يتعرف جهاز
المناعه عليه وبالتالي سيظل الفايروس طليق يتكاثر وينتشر داخل الجسم

❖ Immune evasion by viruses

Production of immune modulators
-1- Soluble cytokine receptors may act as decoys ” and block actions of cytokines , such as (poxviruses).

Viroceptors refer to viral proteins or host cell receptors that viruses exploit during the infection process. This term emphasizes the dual role of certain proteins as both viral receptors and modulators of cellular functions.
Function: Viroceptors can act as viral receptors on the surface of the virus, facilitating attachment and entry into host cells. Additionally, some viruses can manipulate host cell receptors, turning them into viroceptors that modulate cellular functions in favor of the virus.

الي مظلل بالزهري من السلايدات وهي مثال على virokines &viroreceptor وتحتو في شرح بسيط مجرد قراءة لتوضح الفكرة

هون الفكرة انه بعمل decoys receptor يعني كاذب او مخادع بخلي ال ligand الي افرزوا جهاز المناعة عشان يرتبط ع سطح الخلية ويسبب موتها يرتبط بالمستقبل الكاذب بالتالي الخلية ما رح تموت بالتالي الفيروس ما رح يصيرله اشي وبضل عايش وبتكاثر وبنتشر بالجسم

These soluble receptors are often referred to as "decoy receptors" because they mimic the extracellular domain of cell-bound cytokine receptors, preventing the interaction of cytokines with their cellular receptors.

Poxviruses, such as vaccinia virus, encode proteins that serve as soluble cytokine receptors. These viral proteins are produced and secreted into the extracellular environment, where they can bind to cytokines before the cytokines have a chance to interact with their cellular receptors on the surface of host cells.

الحكي والشرح توضيحي يعني اقرأ وامشي

By acting as decoys, the soluble cytokine receptors produced by poxviruses interfere with normal cytokine signaling. This interference can have various effects, including dampening the host immune response. By blocking the action of certain cytokines, poxviruses can create a more favorable environment for their own replication and spread.

-2- Immunosuppressive cytokines, e.g. IL 10 Epstein–Barr virus (EBV)

Epstein-Barr virus (EBV) has been associated with the production of immunosuppressive cytokines, including interleukin-10 (IL-10). IL-10 is a potent anti-inflammatory cytokine that plays a crucial role in regulating the immune response. It is known for its immunosuppressive effects, as it can inhibit the activity of immune cells, such as T cells and antigen-presenting cells.

In the context of EBV infection, the virus has evolved mechanisms to modulate the host immune response to its advantage. Here are some key points:

1) IL-10 Production:

EBV-infected cells, particularly B cells, can produce IL-10.
IL-10 secretion by infected cells contributes to the downregulation of certain aspects of the immune response.
2) Immunomodulation:

IL-10 is involved in immunomodulation, suppressing the activity of cytotoxic T cells and inhibiting the production of pro-inflammatory cytokines.
3) Immune Evasion:

By promoting an immunosuppressive environment through IL-10 production, EBV can evade host immune surveillance and establish persistent infection.

4) Facilitation of B Cell Growth:
IL-10 can also support the growth and survival of B cells, contributing to the proliferation of EBV-infected B cells.

***** How humane papilloma virus cause cancer**

هون الدكتور حكى اقرأوا عن كيفية تسبب HPV في السرطان

The most important gene in retinoblastoma is the RB1 tumor suppressor gene. This gene makes a protein (pRb) that helps stop cells from growing too quickly.

The p53 gene like the Rb gene, is a tumor suppressor gene, i.e., its activity stops the formation of tumors.

Answer: The mechanism of E7 is well-established. It is hypothesized that E7 binds to the retinoblastoma protein (pRb), which inhibits its normal function. During typical cell function, pRb binds to E2F, which is a transcription factor that can activate oncogenes that contain sequences for cyclin E and c-Myc proteins. Cyclin E is needed to advance the cell to mitosis and c-Myc is needed for mitosis. If production of these proteins is uninterrupted by pRb, then the cell continues to divide unregulated. The binding of E7 to pRb also promotes degradation of pRb by the cell's proteasomes, which are large protein complexes that degrade proteins. Both of these outcomes result in cell proliferation. The mechanism for E6 is simpler. The protein E6 binds to p53 and inactivates it. The gene p53 has several roles that regulate the cell cycle, induce apoptosis, promote DNA repair, and prevent tumor growth. Inhibition of p53 would stop these functions and could cause unregulated cell proliferation and cancer.

*** How hepatitis C cause cancer اول اشي الدكتور شرحه الي هو death and regelation وهي شرح مبسط الها

About 30 percent of people who get exposed to the hepatitis C virus will clear it on their own. The rest will go on to have chronic hepatitis C. This ongoing infection causes inflammation in the liver. This extended inflammation can cause scarring, called cirrhosis, and can ultimately lead to liver cancer.

ثاني اشي انه بفرز بروتينات تؤدي الى تكون السرطانات وطلب اسمائهم

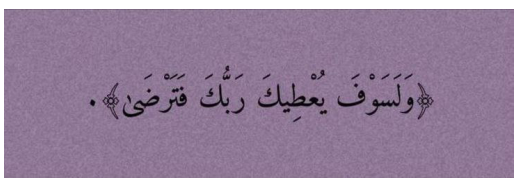
- ◯ At least four of the 10 HCV gene products, **namely core**, ***NS3***, ***NS5A*** and ***NS5B*** play roles in several potentially oncogenic pathways.

هسا هون عن موضوع ال T cell

T-cell-dependent and T-cell-independent B cell activation are two distinct pathways in the immune system with notable differences:

1)T-Cell Involvement:
Dependent Activation: Involves interaction with T helper cells. T helper cells provide necessary signals to B cells for a robust and specific immune response.
Independent Activation: Occurs without direct assistance from T cells. B cells respond directly to antigens without the need for T cell interaction.
2)Antigen Type:

Dependent Activation: Typically involves protein antigens. T cells help B cells recognize and respond to these antigens effectively.
Independent Activation: Often involves non-protein antigens, such as polysaccharides. B cells respond directly to these antigens without T cell assistance.
3)Isotype Switching:
Dependent Activation: Allows for isotype switching, leading to the production of different antibody classes like IgG, IgA, or IgE.
Independent Activation: Often results in the production of IgM antibodies without significant isotype switching.
4)Affinity and Specificity:
Dependent Activation: Typically results in higher affinity antibodies and a more specific immune response due to T cell guidance.
Independent Activation: May produce antibodies with lower affinity and less specificity for the antigen.
5)Memory Response:
Dependent Activation: Induces a more robust and long-lasting memory response, providing enhanced protection upon re-exposure to the same antigen.
Independent Activation: Memory response is often limited, and subsequent encounters with the same antigen may not elicit a strong secondary response.
6)Immunological Memory:
Dependent Activation: Induces the formation of immunological memory, enhancing the ability of the immune system to respond more effectively upon re-exposure.
Independent Activation: Generates less effective and durable immunological memory.



طيب مين الاقوى بيناتهم

T-cell-dependent B cell activation is generally considered stronger than T-cell-independent B cell activation for several reasons:

1)Enhanced Specificity:
T-cell-dependent activation involves the interaction of B cells with T helper cells. This interaction is specific to the antigen presented by the B cell, resulting in a more precise and targeted immune response.
2)Cytokine Support:
T helper cells release cytokines such as interleukin-4 (IL-4) and interleukin-21 (IL-21) upon activation. These cytokines play a crucial role in enhancing B cell proliferation, differentiation, and antibody production.
2)Class Switching:
T-cell-dependent activation allows B cells to undergo class switching, where the constant region of the antibody is changed. This leads to the production of different antibody isotypes (e.g., IgG, IgA, or IgE) with distinct effector functions.
3)Formation of Memory Cells:
T-cell-dependent activation results in the formation of memory B cells, providing long-term immune memory. Memory B cells contribute to a faster and more robust secondary immune response upon re-exposure to the same antigen.
4)Affinity Maturation:
T-cell-dependent activation supports affinity maturation, a process where B cells with higher affinity for the antigen are selectively expanded. This improves the overall effectiveness of the immune response.
5)Sustained Immune Response:

The collaboration between B cells and T helper cells leads to a more sustained and prolonged immune response compared to T-cell-independent activation.

6)Adaptive Immunity:

T-cell-dependent activation is a key aspect of adaptive immunity, allowing the immune system to tailor its response to specific pathogens with a high degree of precision.

While T-cell-independent activation has its role in specific situations, particularly with antigens that have **repeating structures**, T-cell-dependent activation offers a more sophisticated and adaptable immune response, making it generally stronger and more effective in combating a wide range of pathogens.

An antigen with a **repeating structure** refers to a type of antigen that contains repetitive units or patterns in its molecular structure. These repeating units can be identical or similar, occurring in a regular sequence.

The presence of repeating structures can impact the immune response. In the context of the immune system, these repeating structures can be recognized by B cells without the need for T cell assistance. This is a characteristic feature of T-cell-independent B cell activation. Polysaccharide antigens with repeating structures are known to stimulate B cells directly, leading to the production of antibodies.

ال adaptive immunity بنعرفها الي هي ال
Specific /acquired immunity
يعني الاستجابة المتخصصة طيب كيف ال
T cell تعد مفتاح مهم من اجل تنشيطها
بالتالي تصبح الاستجابة المناعية لمسبب المرض دقيقة جدا

Here's a brief overview:

Antigen Presentation: T-cell-dependent activation begins with the presentation of antigens by antigen-presenting cells (APCs) such as dendritic cells. These antigens are typically derived from pathogens like bacteria or viruses.

يعني specific antigen presenting cells بتعرض جزء من ال الفايروس على سطح الخلية

Helper T Cells (CD4+ T Cells): APCs present antigens to helper T cells (CD4+ T cells) via major histocompatibility complex (MHC) molecules. This interaction activates the helper T cells.

ثاني اشي بتيجي خلايا T helper بترتبط ب مسبب المرض على سطح APCs بالتالي بتصير T helper نشطة

Activation of B Cells: Helper T cells play a central role in activating B cells, which are responsible for humoral immunity. B cells are stimulated to proliferate and differentiate into plasma cells, which produce antibodies specific to the presented antigen.

عن طريق T helper 2 بتفرز سيتوكاينات بتحفز تنشيط ال B cell بالتالي plasma cell بالتالي antibodies

Cellular Immunity Activation: Helper T cells also contribute to the activation of cytotoxic T cells (CD8+ T cells), which can directly destroy infected cells.

هاي عن طريق T helper 1 بتفرز سيتوكاينات بتحفز تنشيط نوع اخر من خلايا T ال هي T cytotoxic
ايضا T helper 1 بتساعد بتقوية الاستجابة المناعية الاولية عن طريق افراز IF gamma الي بساعد بتقوية نشاط macrophage

Memory T Cells: Another critical aspect is the generation of memory T cells. These cells "remember" specific pathogens, ensuring a quicker and more robust response upon subsequent encounters with the same pathogen.

اخر اشي تكوين memory cells مسؤولة عن الاستجابة للمرات القادمة بشكل اقوى واسرع واكثر دقة

سؤال

Why polysaccharide vaccine is not effective among infant

Polysaccharide vaccines are less effective in infants because the immune systems of young children have a limited ability to respond to certain types of antigens, such as polysaccharides. Polysaccharides are large molecules composed of sugar units, and they often do not elicit a strong immune response on their own.

In infants, the immune system is still developing, and the T-cell-independent B cell responses, which are crucial for an effective response to polysaccharide antigens, are not fully functional. As a result, infants may not generate a robust and long-lasting immune memory against polysaccharide-based vaccines.

To address this limitation, conjugate vaccines have been developed. Conjugate vaccines link the polysaccharide to a carrier protein, enhancing the immune response, especially in infants. This approach helps stimulate a more effective and sustained immune response, providing better protection against certain pathogens.

A 3-year-old child was brought to the ER. His mother noticed that he became tired, feverish and started to have an itchy rash on his chest and face that spread later to the extremities (shown in the picture). The child was prescribed an antipyretic and calamine lotion to relieve the itch. Which of the following is correct about the causative agent? *

- It is the largest DNA virus
- dsDNA virus with possible reactivation
- ssRNA virus with reverse transcriptase
- Has a long incubation period (10 days - 1 year)
- Transmitted through the fecal-oral route

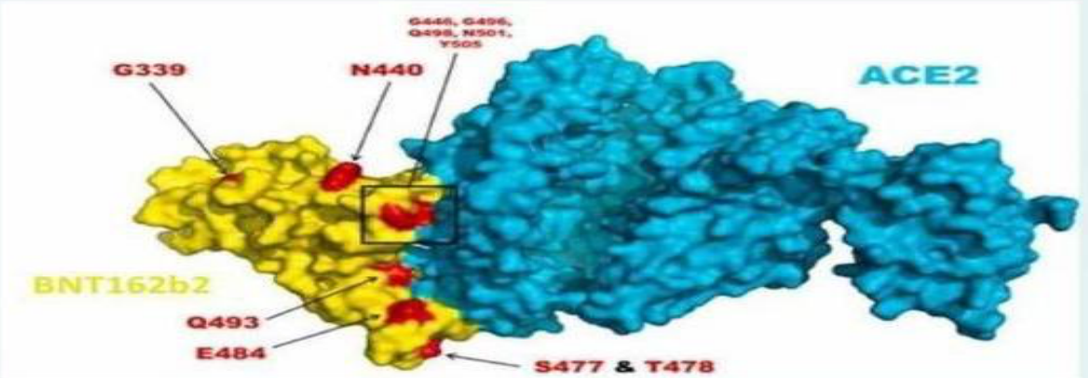
2

A 5-year-old child was brought by his parents to the ER after the appearance of bright red macular exanthem on the cheeks as seen in the picture, in addition to fever, headache, and rhinorrhea one week before the appearance of the rash. Which of the following best describes the virus which is likely to cause this ?condition *

- It is considered to have the smallest genome size
- It is a positive sense single-stranded RNA virus
- It is totally dependent on host cell for replication
- It is an enveloped DNA virus
- It has a helical capsid

1

This figure represents the spike protein-ACE2 receptor complex of SARS-CoV-2, and BNT162b2 represents the Pfizer's vaccine. If a 33-year-old female patient took both shots of the vaccine, mutation at which of the following residues would directly weaken the neutralizing immunity generated as a result of ?vaccination *



- S477
- G339
- N440
- Q493
- T478

تم حفظ لقطة الشاشة في: Pictures/ Screenshot

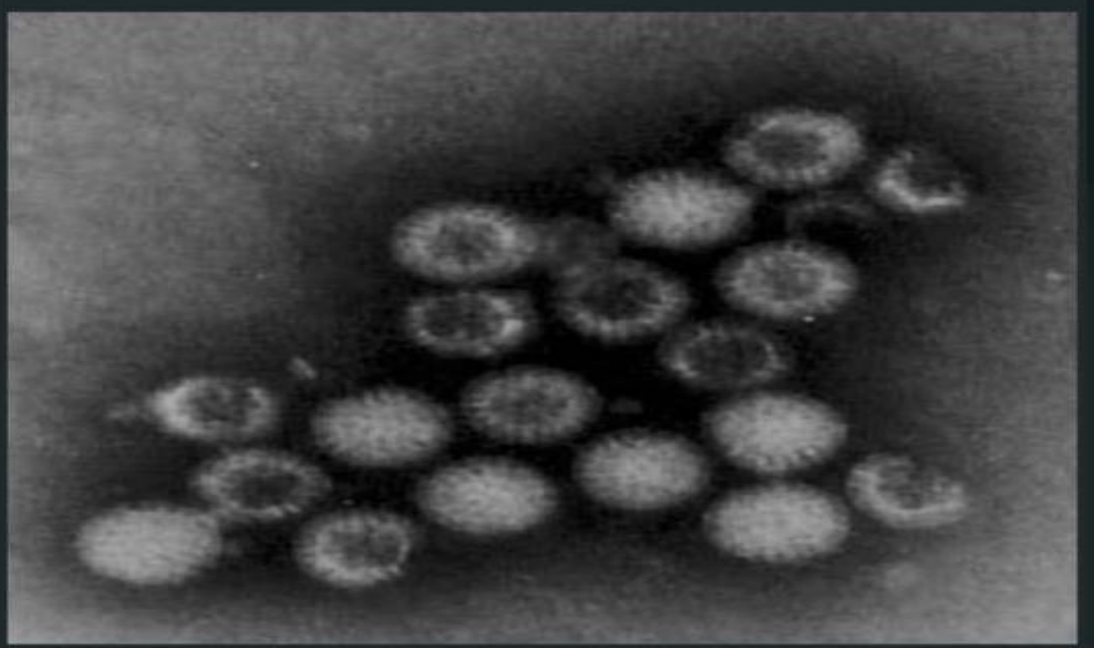
3

Which of the following is CORRECT about
* ?the adsorption step in viral replication

- In naked viruses, adsorption does not necessarily occur to facilitate the virus penetration
- A single spike-receptor complex is sufficient for virus entry into host cell in most viruses
- Influenza virus has two glycoproteins, NA has superior role in viral entry than HA
- Penton projections are used by the adenovirus for adsorption to epithelial cell receptors
- Retroviral entry into target cells require gp160-CD4 receptor interaction only

2

A 2-year-old boy developed diarrhea, vomiting, and fever. Over the following 12 h, the vomiting episodes decreased while the diarrhea became worse (reaching 8 to 10 times). He was then taken to the hospital; the child was in good general condition despite mild dehydration. Stool sample was taken for analysis and the electron microscopy report showed the following picture. What is the most likely causative agent for this child's symptoms? *



- Adenovirus
- Rotavirus
- Coxsackievirus
- Entamoeba histolytica
- Escherichia coli