Immunology

Title : Immunization

Lec no : 16 (the last one)

Done By : Ahmad Hyari
Johainah taha

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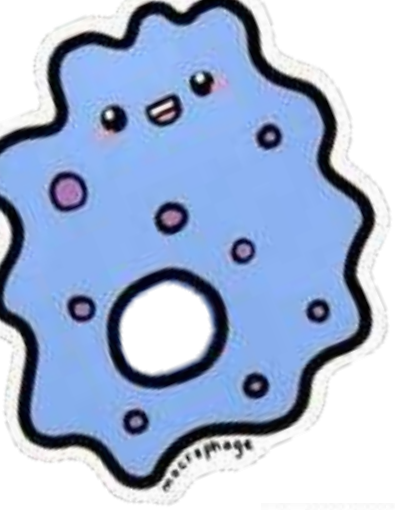
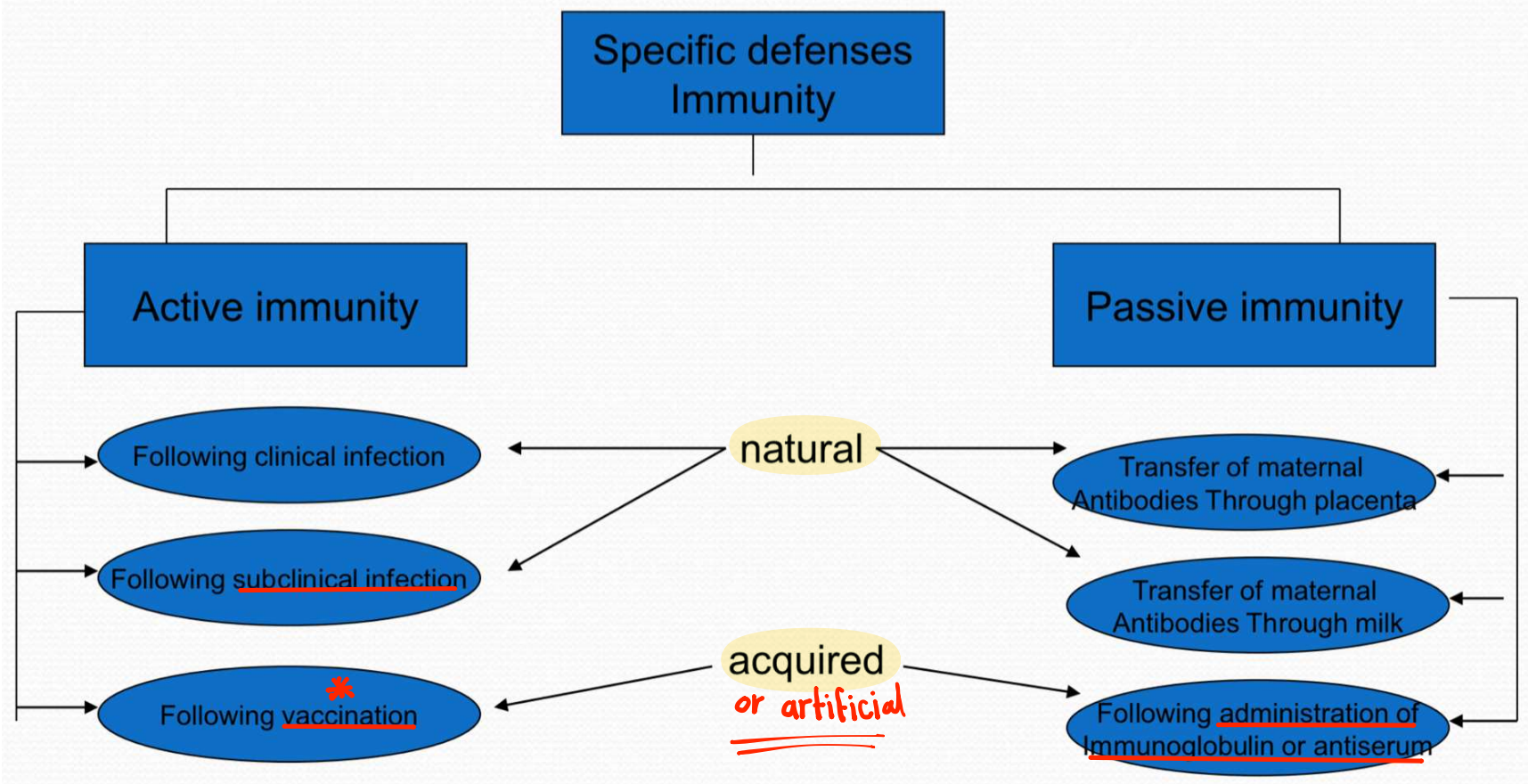


Immunity



Active and passive immunity

- **Active immunity**: Resistance developed in response to stimulus by an antigen (infecting agent or vaccine) and is characterized by the production of antibodies by the host.

- **Passive immunity**: Immunity conferred by an antibody produced in another host. It may be acquired naturally or artificially (through an antibody-containing preparation).

Active immunity

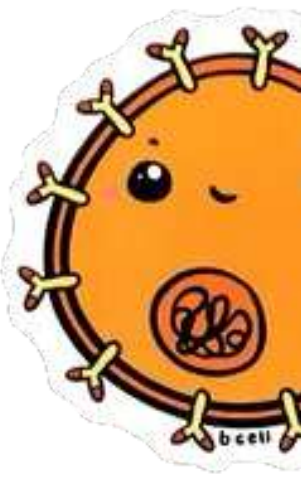
This can happen naturally when a person is exposed to an actual infection and their immune system produces antibodies to fight it off. It can also be achieved artificially through vaccination, where a weakened or inactivated form of the pathogen is introduced to stimulate the immune system without causing illness.

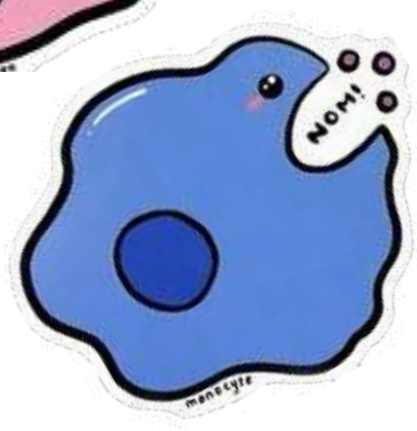
Active immunity provides long-term protection because the immune system "remembers" the pathogen and can respond quickly if exposed again.

Passive immunity

This can occur naturally through the transfer of antibodies from a mother to her baby through breast milk or during pregnancy .

Passive immunity offers immediate but temporary protection, as the body does not develop its own memory of the pathogen and the acquired antibodies eventually degrade.





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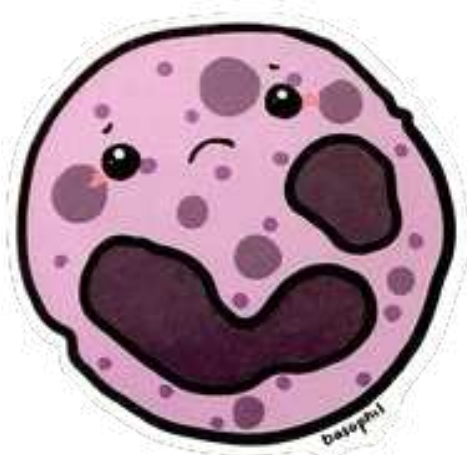
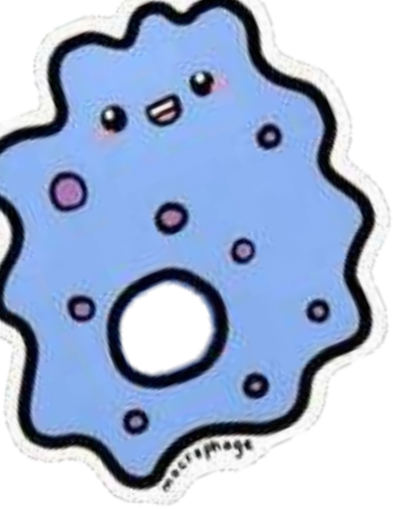
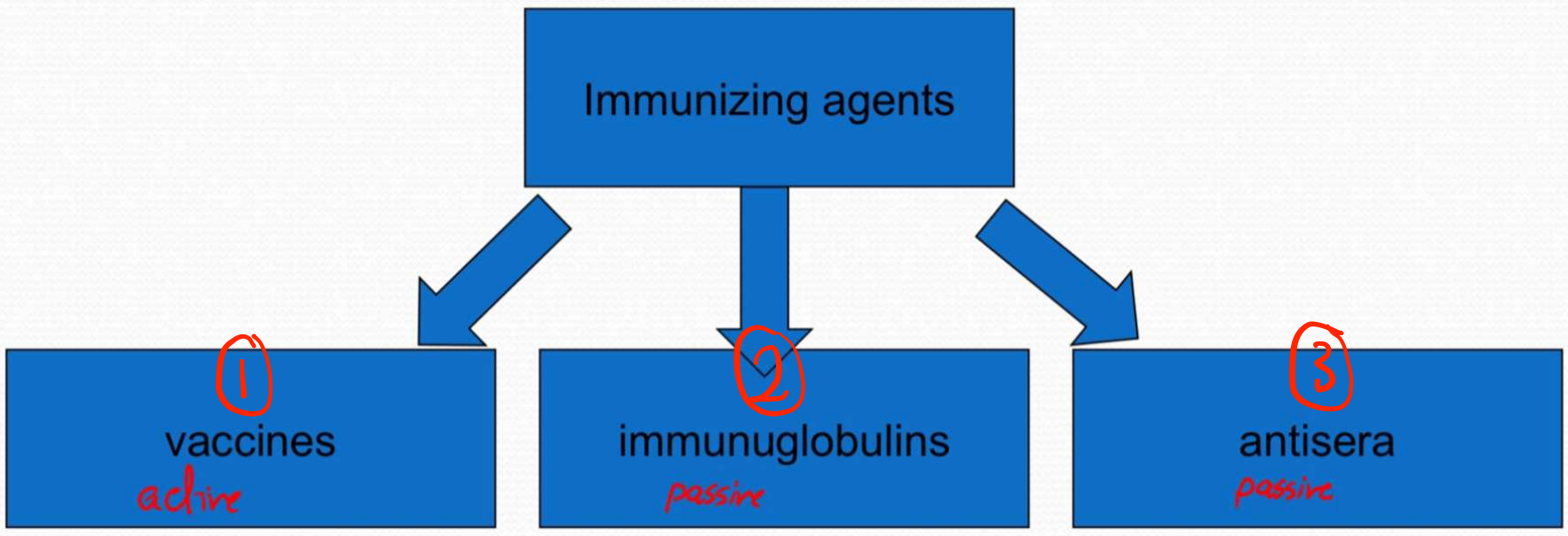




Immunizing agents



- **Immunoglobulins: Two types of immunoglobulin preparations are available for passive immunization:**

- normal human Ig.

- specific (hyper-immune) human Ig.

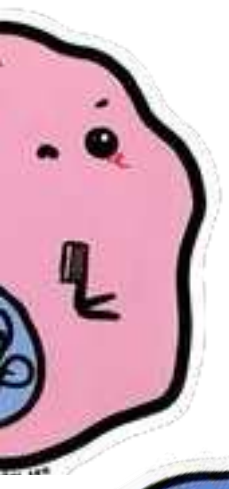
- **Antisera or antitoxins: Human or animal serum containing one or more antibodies that are specific for one or more antigens and are administered to confer immunity.**

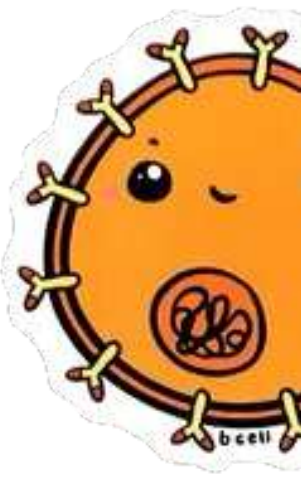
IVIG (intravenous immunoglobulin) can be used for autoimmune diseased

- **Vaccination is a method of giving antigen to stimulate the immune response through active immunization**

1. Antisera: Antisera refers to serum that contains antibodies collected from either humans or animals that have been previously exposed to a particular pathogen or antigen. These antibodies are specific to the antigens associated with that pathogen. When someone is administered antisera, these ready-made antibodies provide immediate protection against the targeted pathogen. This is useful in situations where rapid immunity is needed, such as in cases of snakebites or rabies exposure.

2. Antitoxins: Antitoxins are a specific kind of antisera. They contain antibodies that are specifically designed to neutralize toxins produced by certain bacteria. These antibodies can bind to the toxins and prevent them from causing harm. Antitoxins are commonly used in cases of bacterial infections where the toxins play a significant role in disease progression, like diphtheria or tetanus.





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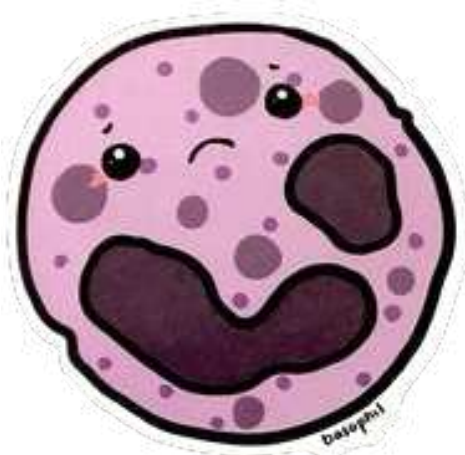
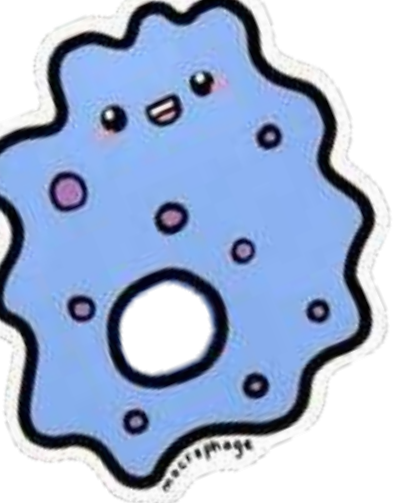
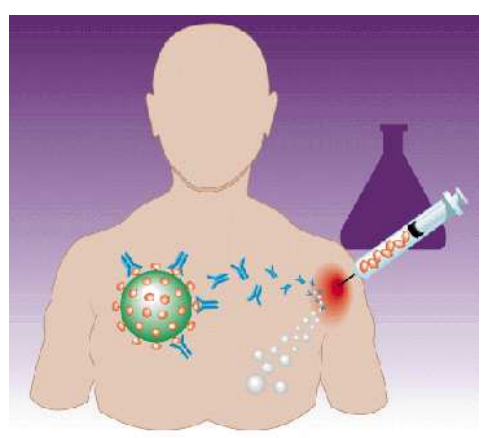




Vaccination



- Vaccination is a method of giving antigen to stimulate the immune response through active immunization.

- A vaccine is an immuno-biological substance designed to produce specific protection against a given disease.

- A vaccine is "antigenic" but not "pathogenic".

Importance of Vaccination

- The most effective and safe methods of preventing deadly infections including viral and bacterial diseases

- Childhood immunization became part of routine health care almost in all countries

- As a results of vaccination: Poliomyelitis, Diphtheria, Tetanus have disappeared in developed countries.
Measles, Rubella and Pertussis become rare. While smallpox has been eradicated.

1. Introduction of Vaccine: When a person receives a vaccine, they are exposed to a small, harmless part of the pathogen (such as a piece of the virus or bacteria) or a weakened or inactivated form of the pathogen. This mimics an actual infection but without causing illness.

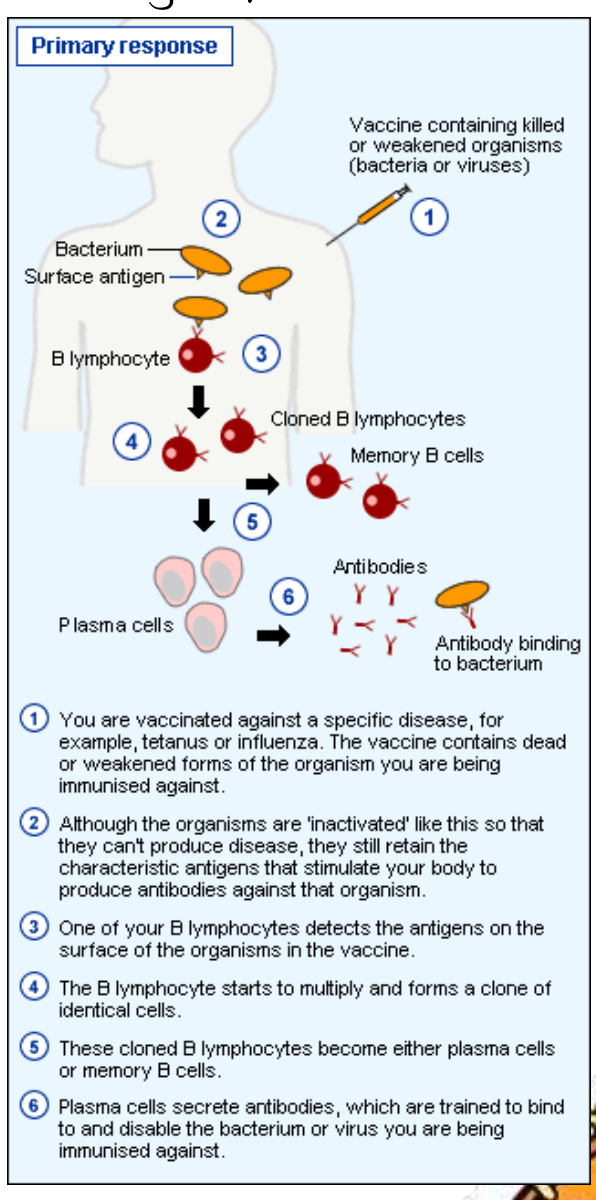
2. Immune System Activation: The immune system recognizes the components of the vaccine as foreign invaders and responds by initiating an immune response. Specialized immune cells, called B cells and T cells, play a key role in this process.

3. Production of Antibodies: B cells produce antibodies that are specifically designed to target the components of the vaccine. These antibodies are a crucial part of the immune response because they can neutralize the pathogen and prevent it from causing harm.

4. Memory Cells Formation: As the immune system responds to the vaccine, some of the B cells and T cells become "memory cells." These memory cells "remember" the pathogen's characteristics, so if the person is exposed to the actual pathogen in the future, the immune system can respond more quickly and effectively.

5. Immune Protection: The antibodies produced during the primary response, along with the memory cells, provide protection against the specific pathogen. If the person encounters the real pathogen later on, their immune system can mount a rapid and strong secondary response, preventing the disease from taking hold or reducing its severity

Primary response to vaccine



اسموا الرسمة و اقرأوا اني بالأزرق

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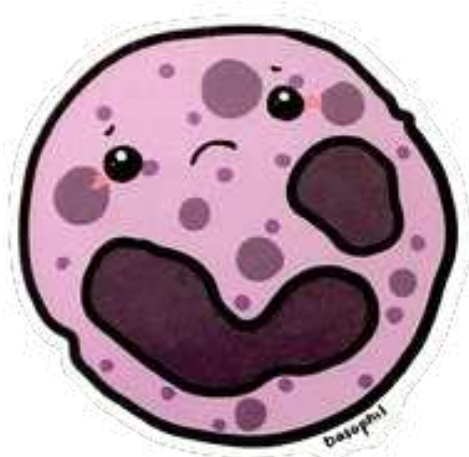
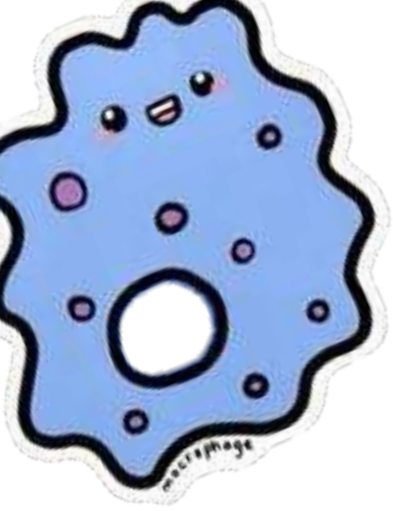




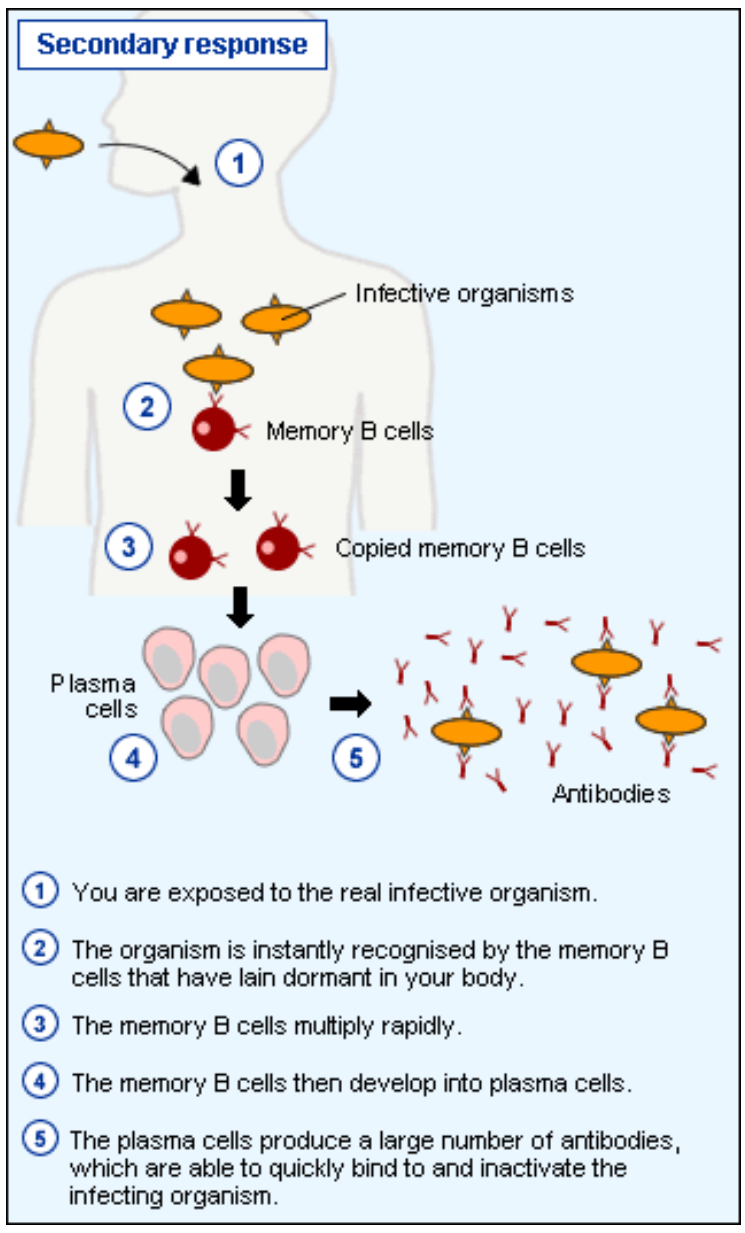
Secondary response to an infection primed by vaccine

• As a result of the initial vaccination, memory B cells and memory T cells are generated. These memory cells "remember" the pathogen's characteristics and remain in the body for an extended period.

• If the person is later exposed to the actual pathogen, their immune system recognizes it quickly due to the presence of memory cells. This recognition leads to a much faster and stronger immune response compared to the first encounter.

• Memory B cells are able to quickly produce a large quantity of antibodies that are specific to the pathogen. These antibodies can neutralize the pathogen before it causes significant harm.

• The rapid and robust immune response ensures that the pathogen is cleared from the body more effectively. This often results in milder or asymptomatic infections, as the immune system is able to control the infection before it can spread extensively



Types of vaccines

1) Live vaccines
2) Attenuated live vaccines
3) Inactivated (killed vaccines)
4) Toxoids
5) Polysaccharide and polypeptide (cellular fraction) vaccines → جزء من البكتيريا مثل Capsule
6) Surface antigen (recombinant) vaccines.

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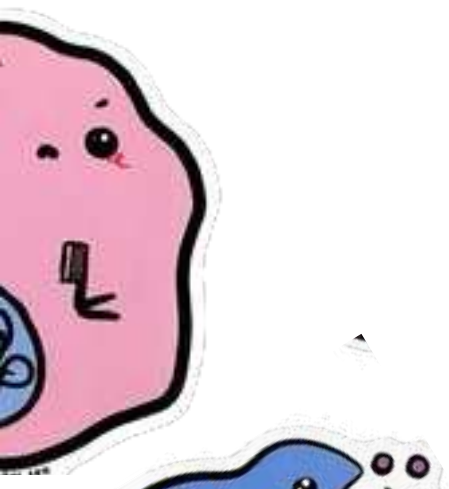

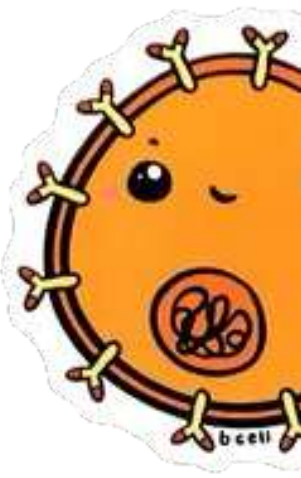

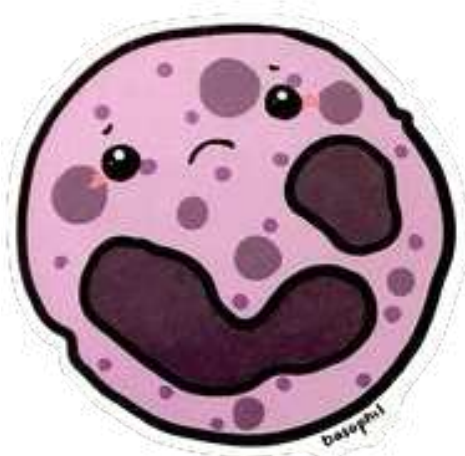

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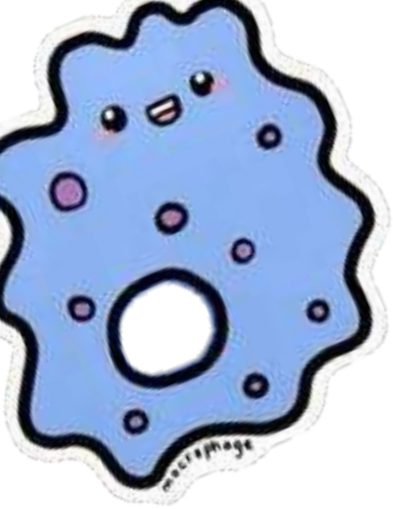


1. Live vaccines

- Live vaccines are made from live infectious agents without any amendment.

- The only live vaccine is "Variola" small pox vaccine, made of live vaccinia cow-pox virus (not variola virus) which is not pathogenic but antigenic, giving cross immunity for variola."

Live vaccines based on cross immunity (corss reactivity)

- Cross reactivity refers to the ability of an individual antibody combining site to react with more than one antigenic determinant or the ability of a population of antibody molecules to react with more than one antigen.

It is contradicated in immune deficient patients

2. Live attenuated (avirulent) vaccines

- Virulent pathogenic organisms are treated to become attenuated and avirulent but antigenic. They have lost their capacity to induce full-blown disease but retain their immunogenicity.

- Live attenuated vaccines should not be administered to persons with suppressed immune response due to:

1- Leukemia and lymphoma
2- Other malignancies
3- Receiving corticosteroids and anti-metabolic agents
4- Radiation
5- Pregnancy

لُقاح مُضعف و مُخفف و ما بيعمل infection او disease هو بس بيعمل immune response و منيح لل immunodeficient patients

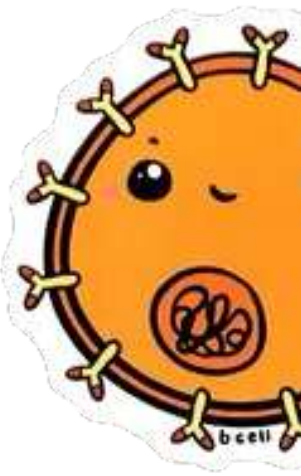
Live attenuated vaccines are designed in such a way that the attenuated pathogens are no longer capable of inducing the severe symptoms associated with the full-blown disease. This means that while the vaccine pathogen may still replicate to some extent, it does not cause the illness it would have caused in its original, unmodified state

3. Inactivated (killed) vaccines

- Organisms are killed or inactivated by heat or chemicals but remain antigenic. They are usually safe but less effective than live attenuated vaccines.

The only absolute contraindication to their administration is a severe local or general reaction to a previous dose.

Contradicated only for hypersensitive patients



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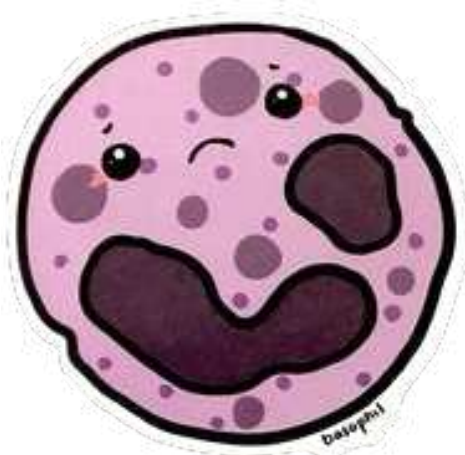
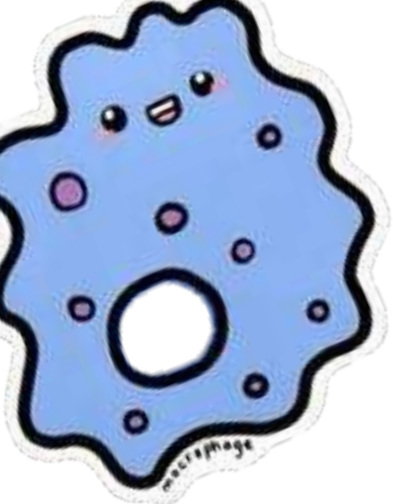




4. Toxoids

- They are prepared by detoxifying the exotoxins of some bacteria rendering them antigenic but not pathogenic. Adjuvant (e.g. aluminum precipitation) is used to increase the potency of vaccine

This means that if an individual had a serious adverse reaction (such as a severe allergic reaction) to a specific inactivated vaccine in the past, healthcare professionals would advise against giving them the same vaccine again. In such cases, an alternative vaccine or approach might be considered.

- The antibodies produces in the body as a consequence of toxoid administration neutralize the toxic materials produced during infection rather than act upon the organism itself. In general toxoids are highly efficacious and safe immunizing agents.

Most of vaccines contain adjuvants in minimal concentrations, that have an additive effect in triggering stronger immune responses. Ex. DTaP vaccine (Diphtheria, Tetanus, Pertussis)

5. Polysaccharide and polypeptide (cellular fraction) vaccines

- They are prepared from extracted cellular fractions e.g. meningococcal vaccine from the polysaccharide antigen of the cell wall, the pneumococcal vaccine from the polysaccharide contained in the capsule of the organism, and hepatitis B polypeptide vaccine & and haemphilus influnzae vaccine

1. 3. 4.

- Their efficacy and safety appear to be high.

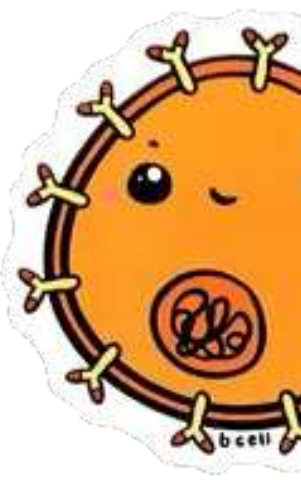
There are 2 types of polysaccharide vaccines: conjugated and unconjugated.
For vaccines to be efficacious, effective and confer immunity for children < 2 yrs they need to be conjugated (it's related to T-cells dependent and independent immunity)

6. Surface antigen (recombinant) vaccines.

- It is prepared by cloning HBsAg gene in yeast cells where it is expressed. HBsAg produced is then used for vaccine preparations.

- Their efficacy and safety also appear to be high. Ex : hepatitis B

Note : The is No vaccine for Hepatitis C



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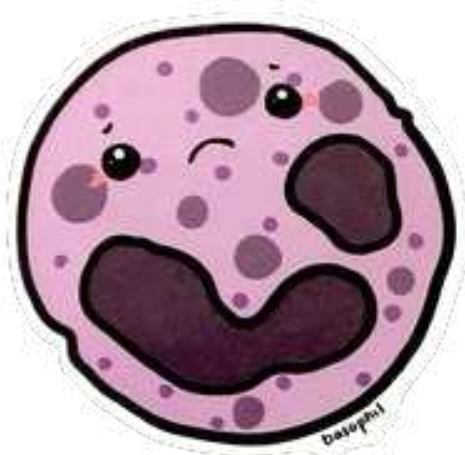
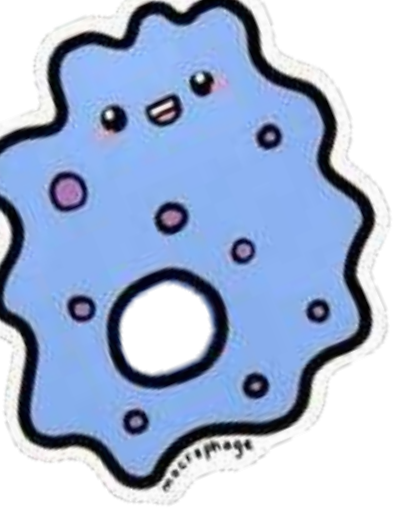
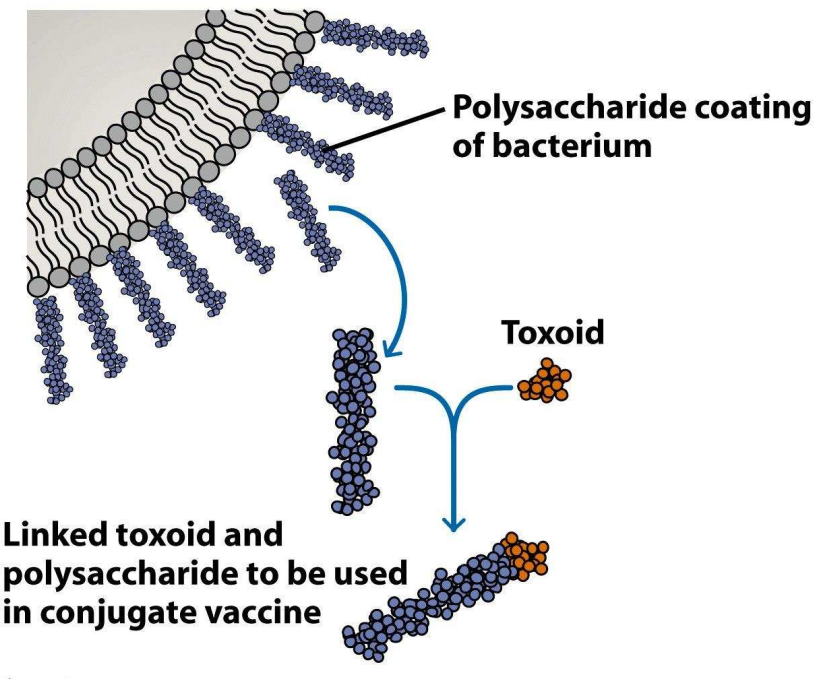




Conjugate vaccines

A conjugate vaccine is created by covalently attaching a (polysaccharide organism) antigen to a carrier protein (preferably from the same microorganism), thereby conferring the immunological attributes of the carrier on the attached antigen.



بعمله conjugate لاكبر حجمه و ازيد ال immune response ضده

This technique for the creation of an effective immunogen is most often applied to bacterial polysaccharides.

Types of vaccines

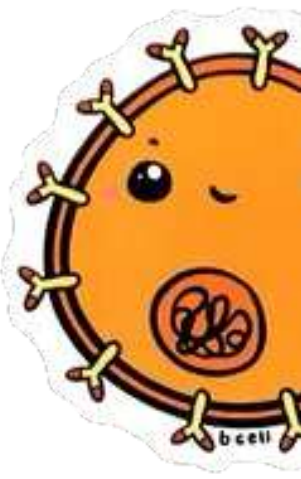
الدكتور حكى ركزوا على الي بالاحمر خصوصا ال live
attenuated حابين بس تحفظوهم حرين 🤭

Live vaccines	Live Attenuated vaccines	Killed Inactivated vaccines	Toxoids	Cellular fraction vaccines	Recombinant vaccines
•Small pox variola vaccine	•**BCG** •Typhoid oral •Plague •**Oral polio** •Yellow fever •**Measles** •**Mumps** •**Rubella** •Intranasal Influenza •Typhus	•Typhoid •Cholera •**Pertussis** •Plague •Rabies •Salk polio •Intra-muscular influenza •Japanise encephalitis	•**Diphtheria** •**Tetanus**	•**Meningococcal polysaccharide vaccine** •**Pneumococcal polysaccharide vaccine** •**Hepatitis B polypeptide vaccine**	•**Hepatitis B vaccine**

Routes of administration

بس اعرفوا انه تختلف الطرق لاعطاء الvaccine

- Deep subcutaneous or intramuscular route (most vaccines)
- Oral route (sabine vaccine, oral BCG vaccine)
- Intradermal route (BCG vaccine)
- Scarification (small pox vaccine)
- Intranasal route (live attenuated influenza vaccine)



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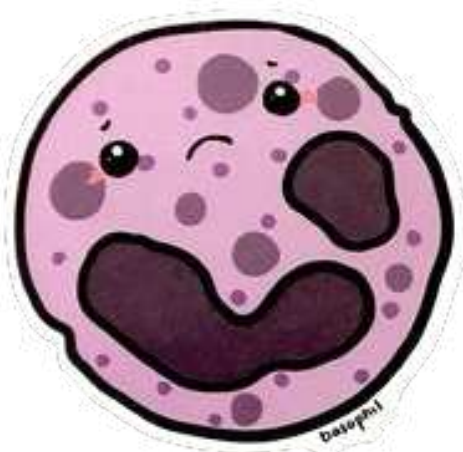
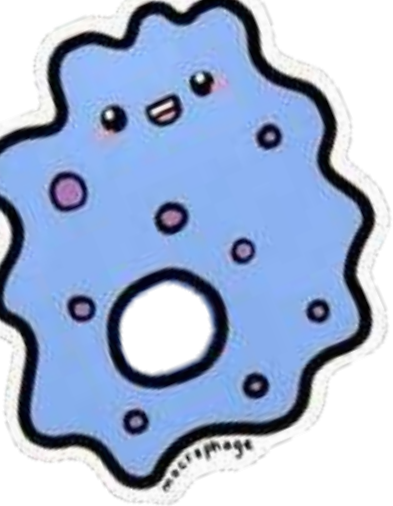




Scheme of immunization

- **Primary vaccination**

- One dose vaccines (BCG, variola, measles, mumps, rubella, yellow fever)
- Multiple dose vaccines (polio, DPT, hepatitis B)

- **Booster vaccination**

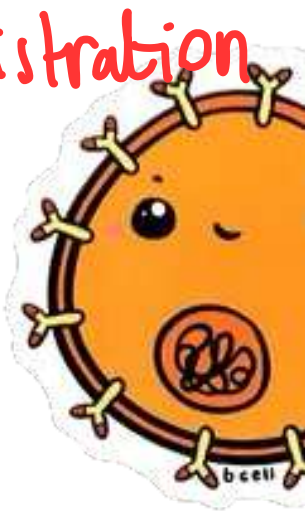
To maintain immunity level after it declines after some time has elapsed (DT, MMR).

One-dose vaccines and multiple-dose vaccines serve different purposes based on the type of vaccine and the desired immune response. Some vaccines require multiple doses to build a stronger and longer-lasting immunity. These additional doses, known as booster shots, help enhance the body's immune memory and maintain protection over time. On the other hand, certain vaccines are designed to provide sufficient immunity with just one dose due to the nature of the pathogen they target or the technology used in their development.

Vaccine	Type of vaccine	Disease
BCG	Live attenuated Bacteria	Tuberculosis
OPV (Oral Polio)	Live attenuated Virus	Poliomyelitis
DPT	-D & T (Fractional (Toxoid) -Pertussis (Inactivated whole bacteria)	_Diphtheria & Tetanus _Pertussis
Measles	Live attenuated Virus	Measles
MMR	Live attenuate Virus (Measles +Mumps+ Rubella)	Measles -Mumps -Rubella
HBV	Recombinant (HBSAg)	Hepatitis B
Hib	Fractional(Conjugate Polysaccharide)	Haemophilus Influenza B
IPV	Inactivated polio virus	Poliomyelitis

قرأه highlight اللي عليه الدكتور

معهم جداً انتبهوا لمرض ال Poliomyelitis انه اله 2 vaccines والفرق بينهم بال Rout of administration



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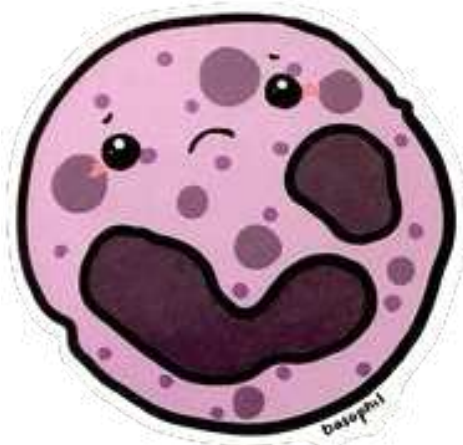

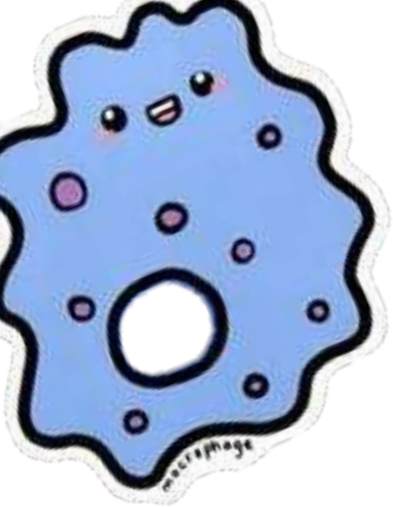

البرنامج الوطني للتطعيم، مو مطلوب بس برأيي اعرفوا
انه ال BCG اول واحد

Age	Vaccine
1st contact	BCG
2 months	DaPT1 IPV1+Hib+1HepB1
3 months	DaPT2 IPV2+Hib2+HepB2+OPV
4 months	DaPT3 IPV3+Hib3+HepB3+OPV
9 months	Measles + OPV
12 months	MMR1
18 months	DPT booster1 +OPV booster1 +MMR2

Levels of effectiveness

- Absolutely protective(100%): yellow fever vaccine
- Almost absolutely protective (99%): Variola, measles, mumps, rubella vaccines, and diphtheria and tetanus toxoids.
- Highly protective (80-95%): polio, BCG, Hepatitis B, and pertussis vaccines.
- Moderately protective (40-60%) TAB, cholera vaccine, and influenza killed vaccine.

في عنا فايروسات بتحمي بنسبة 100% و في منهم بس بخففوا المرض لما ننصاب فيه زي كورونا و في منهم
ممكن يحمونا لفترة قصيرة و بعدها مستوى ال antibody يرجع ينخفض

Antibody Titer

- A test to measures the presence and amount of antibodies in blood against a particular type of tissue, cell, or substance
- Titer determines if you have adequate protection against a disease
- May need to give booster if titer too low
- E.g., happens with HepB vaccine ← مهم للطلاب

Hazards of Immunization

- The adverse reactions that may occur include:

1. Reactions inherent to inoculation: local and general → ex: headach. fever.

As in covid-19: swelling, pain,heaviness in the arm. And in BCG vaccine.

2. Reactions due to faulty techniques: during manufacturing or giving of vaccine
3. Reactions due to hypersensitivity
4. Neurological involvement: GuillainBarre syndrome in association with the swine influenza vaccine ← rare
5. Provocative reactions: occurrence of new disease not connected to the vaccine

For example, imagine a person receives a vaccine and a few days later experiences symptoms of a cold. While it might be tempting to link the vaccine and the cold symptoms, it's more likely that the person was already exposed to the cold virus before or around the same time as the vaccination. The vaccine itself would not be the cause of the cold.

وَقُل رَّبِّ زِدْنِي عِلْمًا