Child vaccination and immunization

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Vaccines definition

- "vaccine" originates from the Latin

  Variolae vaccinae (cowpox), which Edward Jenner demonstrated in 1798 could prevent smallpox in humans.

- 'Vaccine today': Are all biological preparations, produced from living organisms, that enhance immunity against disease.

Vaccines

- Immunization stands as one of the most powerful achievements in the history of public health:

transforming devastating diseases into preventable conditions.

Example: Smallpox vaccine

- The smallpox vaccine prevents smallpox infection using alive poxvirus called vaccinia. Introduced by Edward Jenner in 1796, it led to Vaccinia led to Total global eradication of smallpox.

  So Smallpox vaccination stopped.

- but samples kept for future if needed.

Small box prevented and eradicated by Vaccinia

Same for Poliomyelitis : nowadays rarely seen due to vaccination

Tetanus also .

Whooping cough/ Diphtheria/measels

Rarely seen nowadays

Due to effect of vaccines: Dramatic decrease in morbidity reaching 100% for most of diseases

Table 1.1. Comparison of 20th Century Annual Morbidity and Current Morbidity: Vaccine-Preventable Diseases[a]

Disease	20th Century Annual Morbidity[b]	2010 Reported Cases[c]	Percent Decrease
Smallpox	29 005	0	100
Diphtheria	21 053	0	100
Measles	530 217	63	>99
Mumps	162 344	2612	98
Pertussis	200 752	27 550	86
Polio (paralytic)	16 316	0	100
Rubella	47 745	5	>99
Congenital rubella syndrome	152	0	100
Tetanus	580	26	96
Haemophilus influenzae	20 000	246[d]	99

[a]National Center for Immunization and Respiratory Diseases. Historical Comparisons of Vaccine-Preventable Disease

Copenhagen Consensus: One of the 10 most cost effective solutions to major global challenges with limited resources: Vaccination

Table: The ten most cost-effective solutions to major global challenges, Copenhagen Consensus 2008

	Solution	Challenge
1	Micronutrient supplements for children (vitamin A and zinc)	Malnutrition
2	The Doha development agenda	Trade
3	Micronutrient fortification (iron and salt iodization)	Malnutrition
4	Expanded immunization coverage for children	Diseases
5	Biofortification	Malnutrition
6	Deworming and other nutrition programmes at school	Malnutrition & Education
7	Lowering the price of schooling	Education
8	Increase and improve girls' schooling	Women and development
9	Community-based nutrition promotion	Malnutrition
10	Provide support for women's reproductive role	Women and development

Active Vs Passive Immunization Comparison

ACTIVE	PASSIVE
vaccine is given then the body forms its own protective antibodies.	Ready-made immune globulin (antibodies) from human or animal sources are given to the body.
Long term protection (Sometimes life long)	**Temporary** immunity that decreases with time (turnover of the administered immunoglobulin)
Can be in 2 ways: **1-Natural**: Infection **2-Artificial**: Vaccination	Examples: Mother's immunoglobulin to infant (transplacental/breast milk) effective for about 6 months. **Artificial**: Adminestration of antibodies (e.g: Hepatitis B IG, Varicella IG)

Passive immunization indications

- 1)benefits individuals unable to produce antibodies (eg, immunocompromised patients).

- 2) when rapid disease progression before the development of active immunity :
- Rabies exposure; the patient may contract the disease before the immune system generates a sufficient antibody.

Passive immunization from the mother

- A newborn baby has passive immunity through the placenta to several diseases like: measles, mumps rubella, which lasts for a few weeks or months. up to one year.

Active immunization: Vaccine types

- Live attenuated: weekend living organisms, by cultivation under sub-optimal conditions,

  or genetic modification.
- Inactivated: whole organisms inactivated by chemical, thermal or others.
- Recombinant. the insertion of the DNA section responsible for encoding the antigen. (Yeast)
- Toxoid. inactivated toxins.
- From conjugation: of polysaccharides to proteins: meningococcal, pneumococcal, H.inflenizea.

Figuer 1: Vaccine composition(Types)

Live attenuated V.

Inactivated V.

Recombinant V.

Toxoid V.

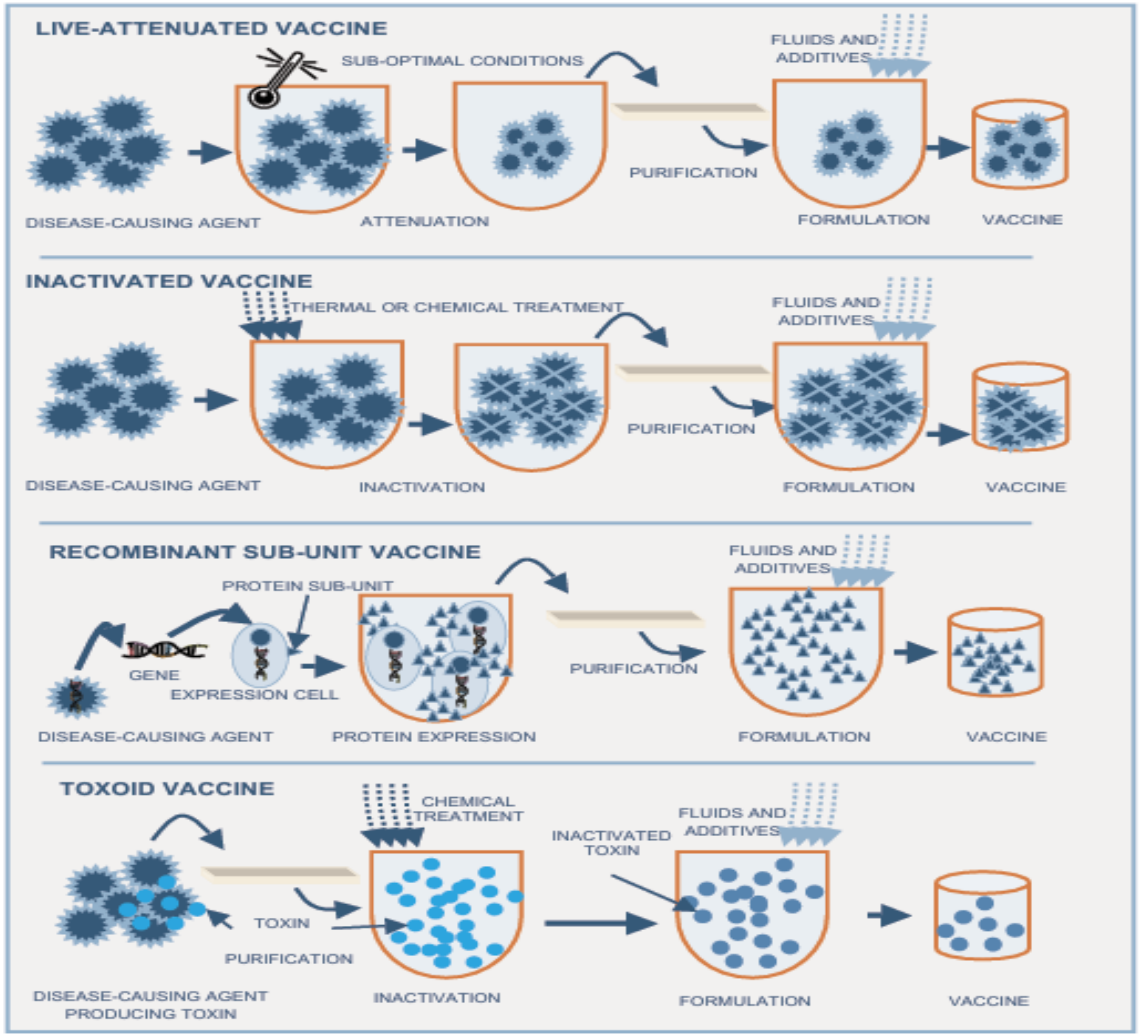
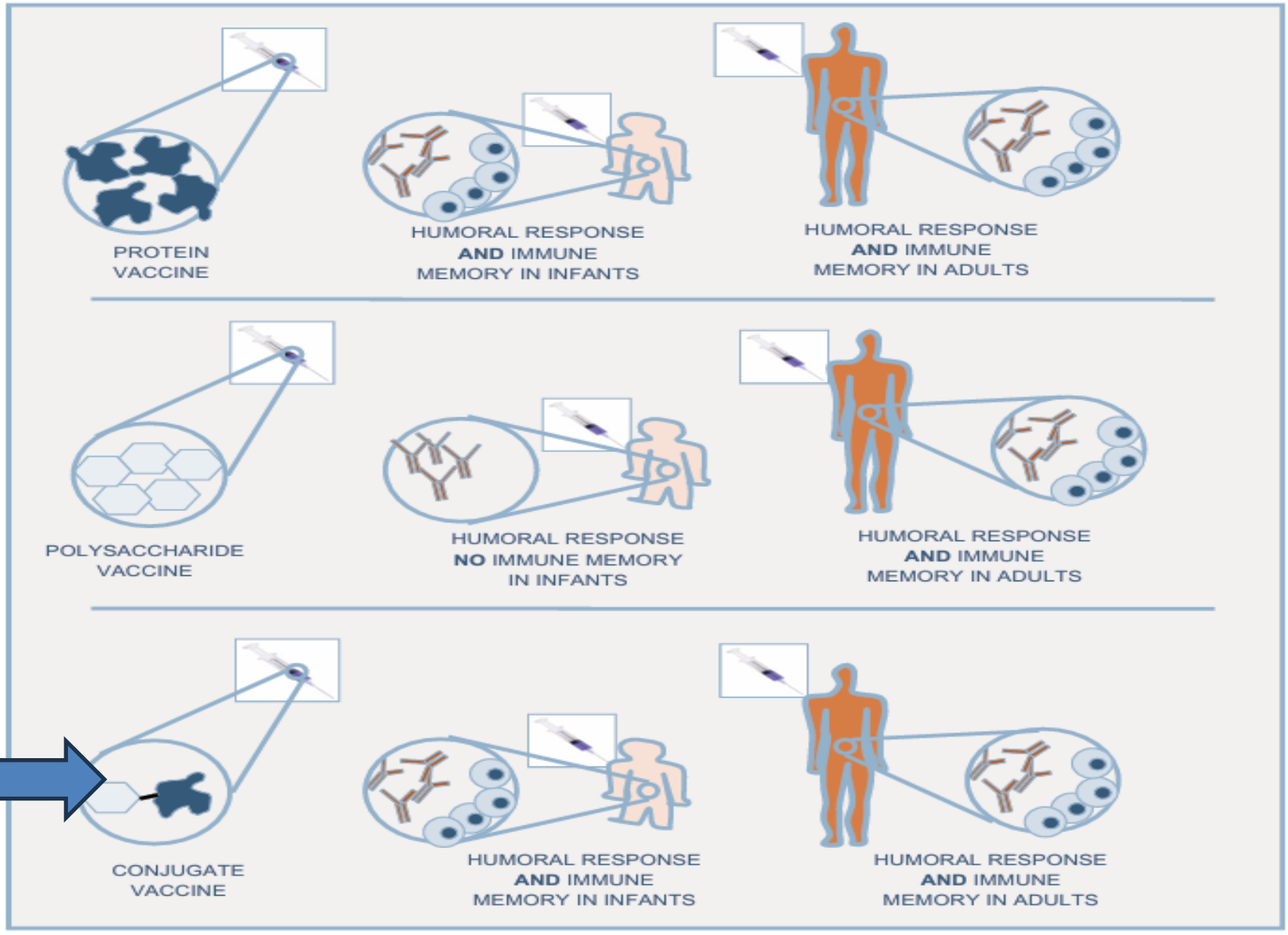


Figure2 ;From the linkage (conjugation) of polysaccharides to proteins



Subunit vaccines cont..

Benefits: Subunit vaccines only contain pieces of a pathogen, cannot cause infection. suitable for people who should not receive “live” vaccine :

- young children.
- older people.
- immunocompromised people.

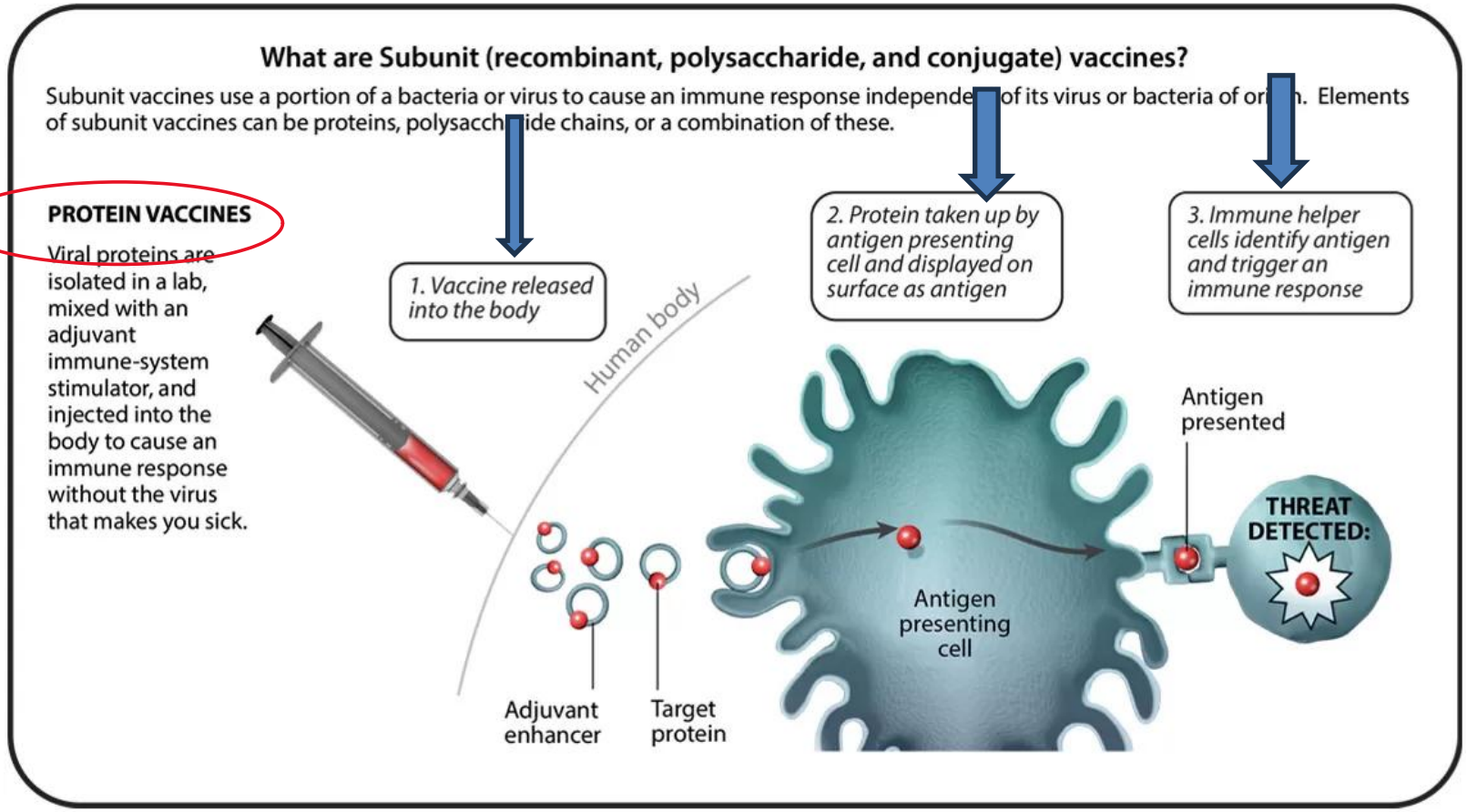
Examples:

- Haemophilus influenzae type B (Hib) vaccine (conjugate),
- Pneumococcal vaccine (polysaccharide or conjugate),
- Shingles vaccine (recombinant protein),
- Hepatitis B (recombinant protein),
- Acellular pertussis (conjugate).

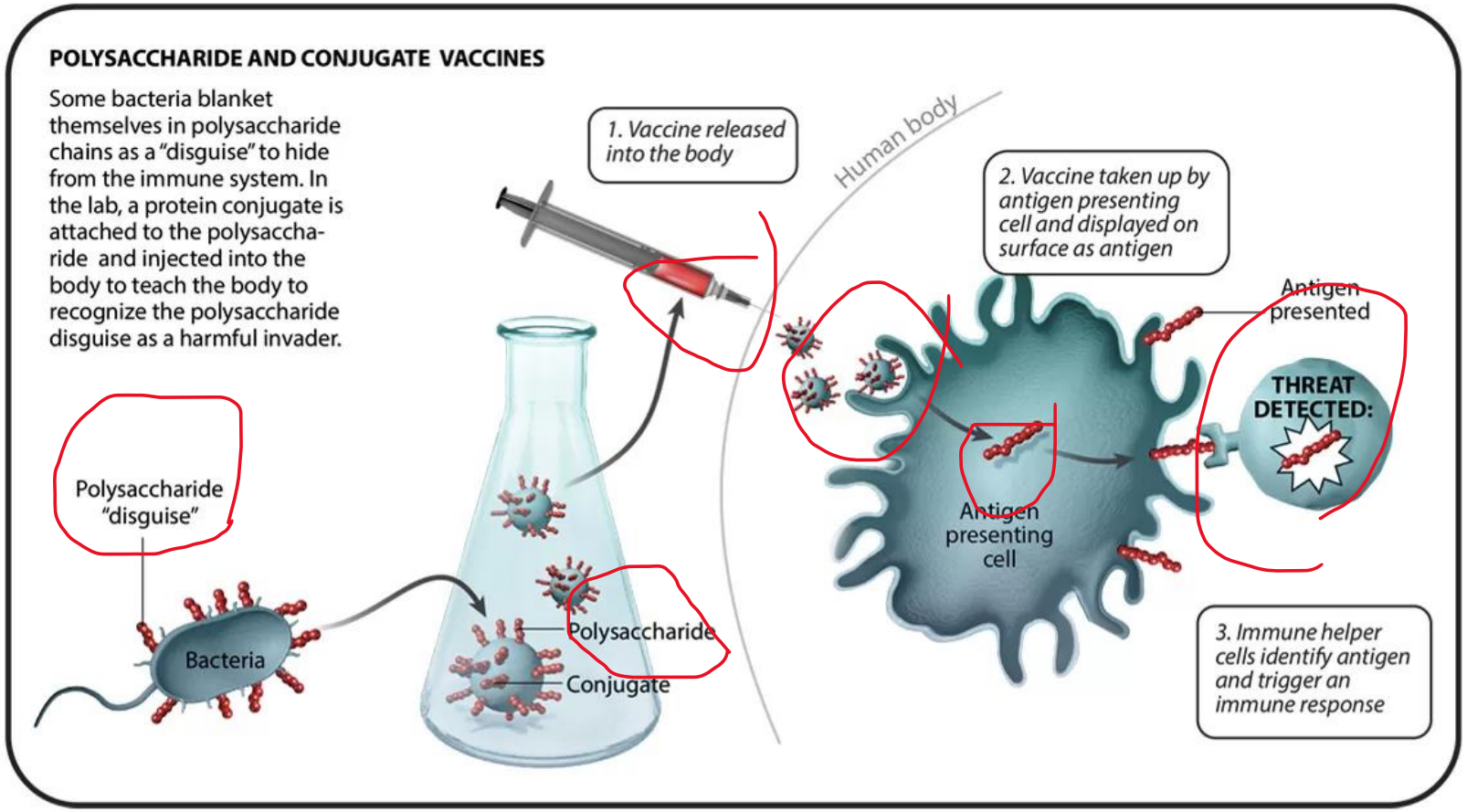
Polysaccharide Vaccines(when conjugated to protein)

- This way the polysaccharide vaccine will stimulate a T cell DEPENDENT immune response.
- Induce an immune response in children younger than 2 y.
- Have a booster response.

Recombinant+ Polysaccharide +conjugate Vaccines



Polysaccharide & Conjugate vaccine



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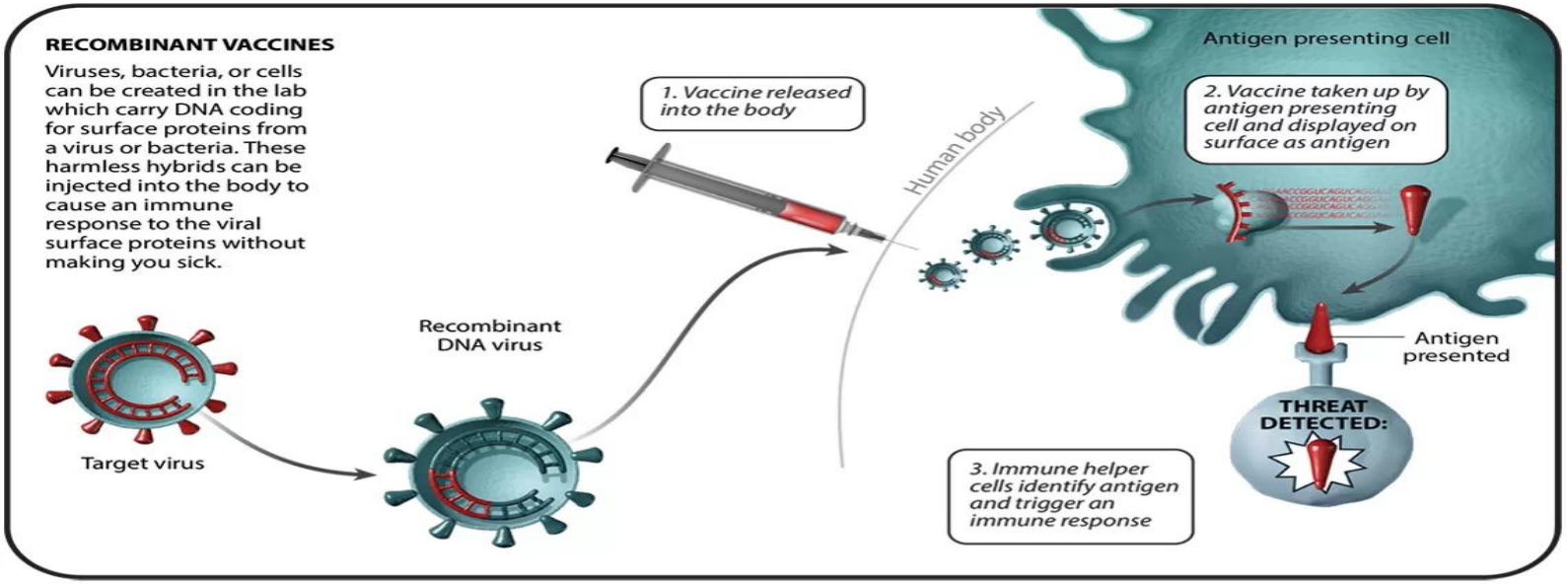
Polysaccharide Vaccines

- Pure polysaccharide vaccines:
  - Induce a T-cell INDEPENDENT immune response.
    - Stimulate B cells without the need for T helper cells (humoral immunity only)
    - Not immunogenic in children younger than 2 years of age (underdeveloped immune system. B cells must be activated through T cells)
    - No booster response in adults (antibody titers don't increase).

Recombinant Vaccines

- Manufactured by inserting viral genes that code for important key antigens into common baker's yeast.
  - The yeast then produces the antigens, which are collected and purified for use in the vaccine



Toxoid vaccines 1

Toxoid vaccines inactivated toxins to target the toxic activity created by the bacteria, rather than targeting the bacteria itself.

The goal of toxoid vaccines is to give people a way to neutralize those toxins with antibodies through vaccination.

preventing toxin-mediated diseases such as

Tetanus(***Clostridium tetani***.),

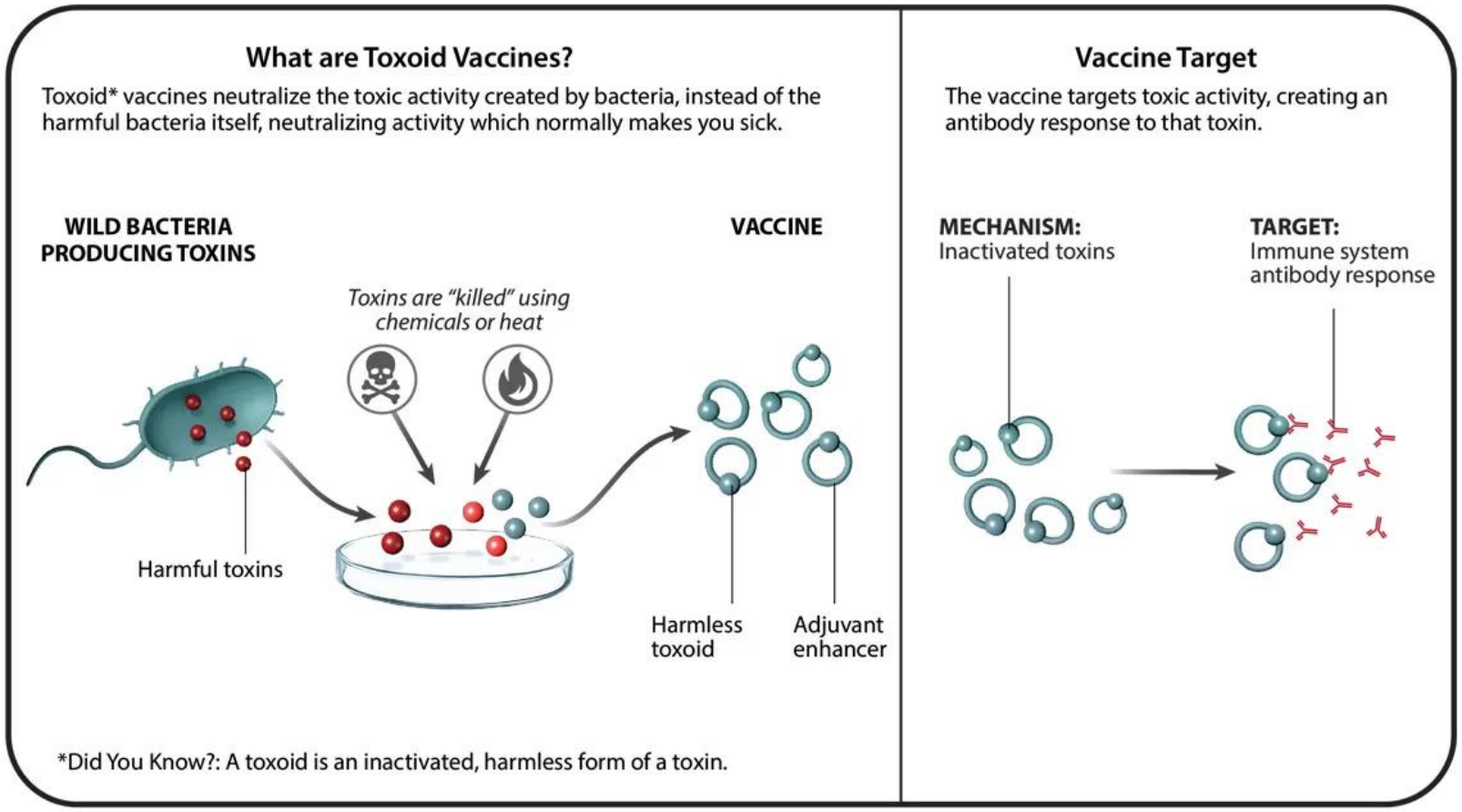
diphtheria Corynebacterium diphtheriae)

pertussis(Bordetella pertussis)

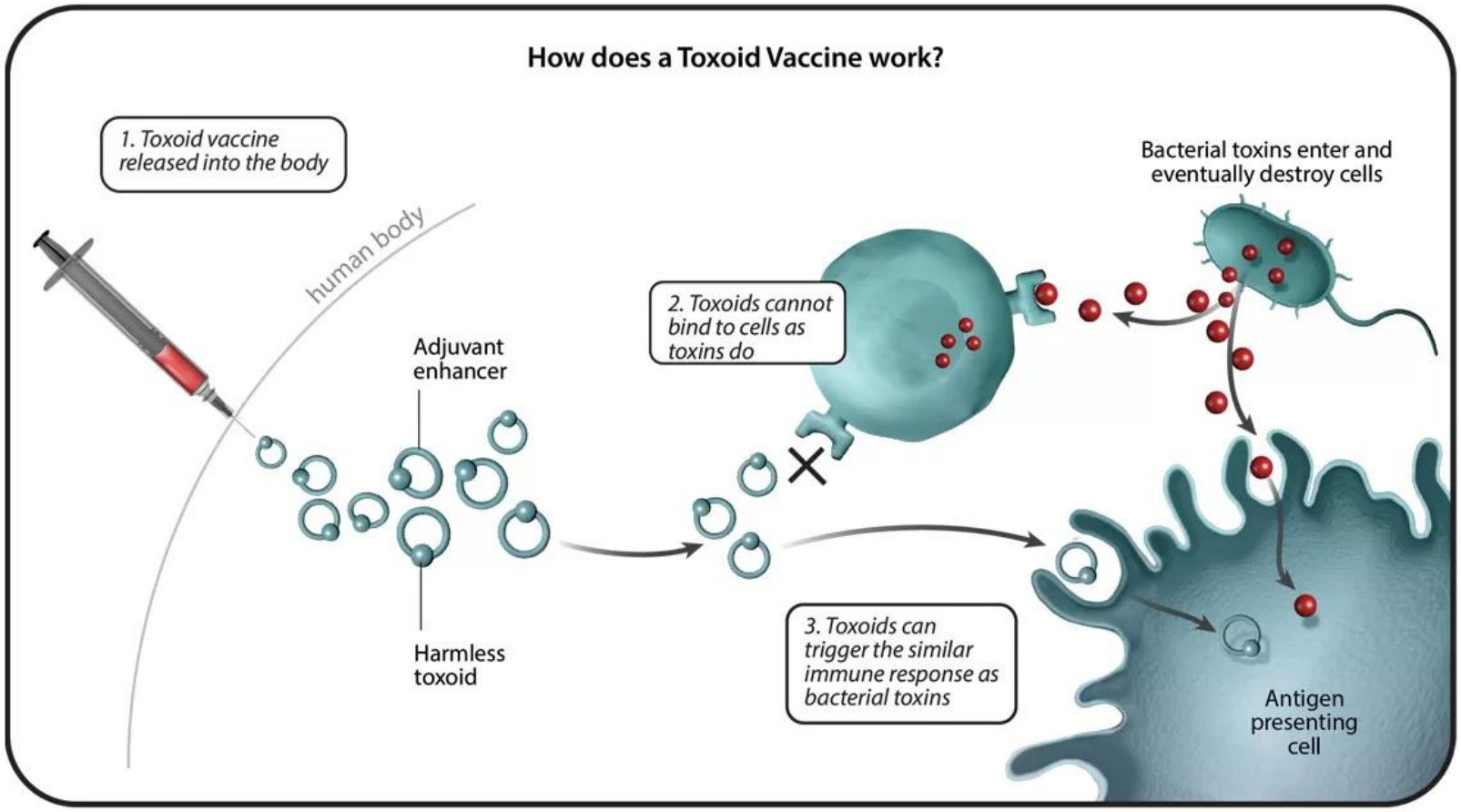
These vaccins good to be repeated every 10 years.

DPT

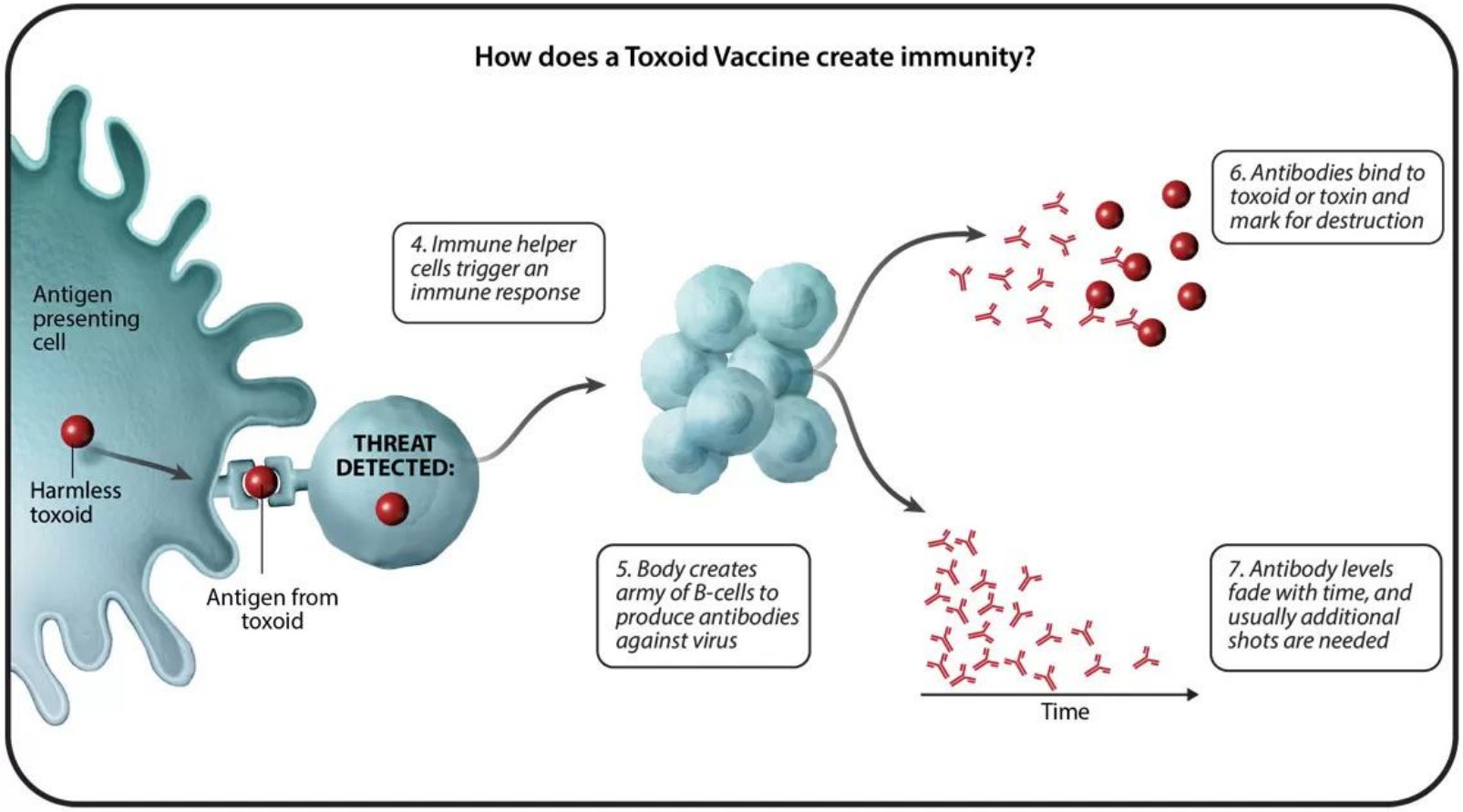
Toxoid vaccines cont . 2



Toxoid Vaccine cont.3



Toxoid vaccine cont. 4



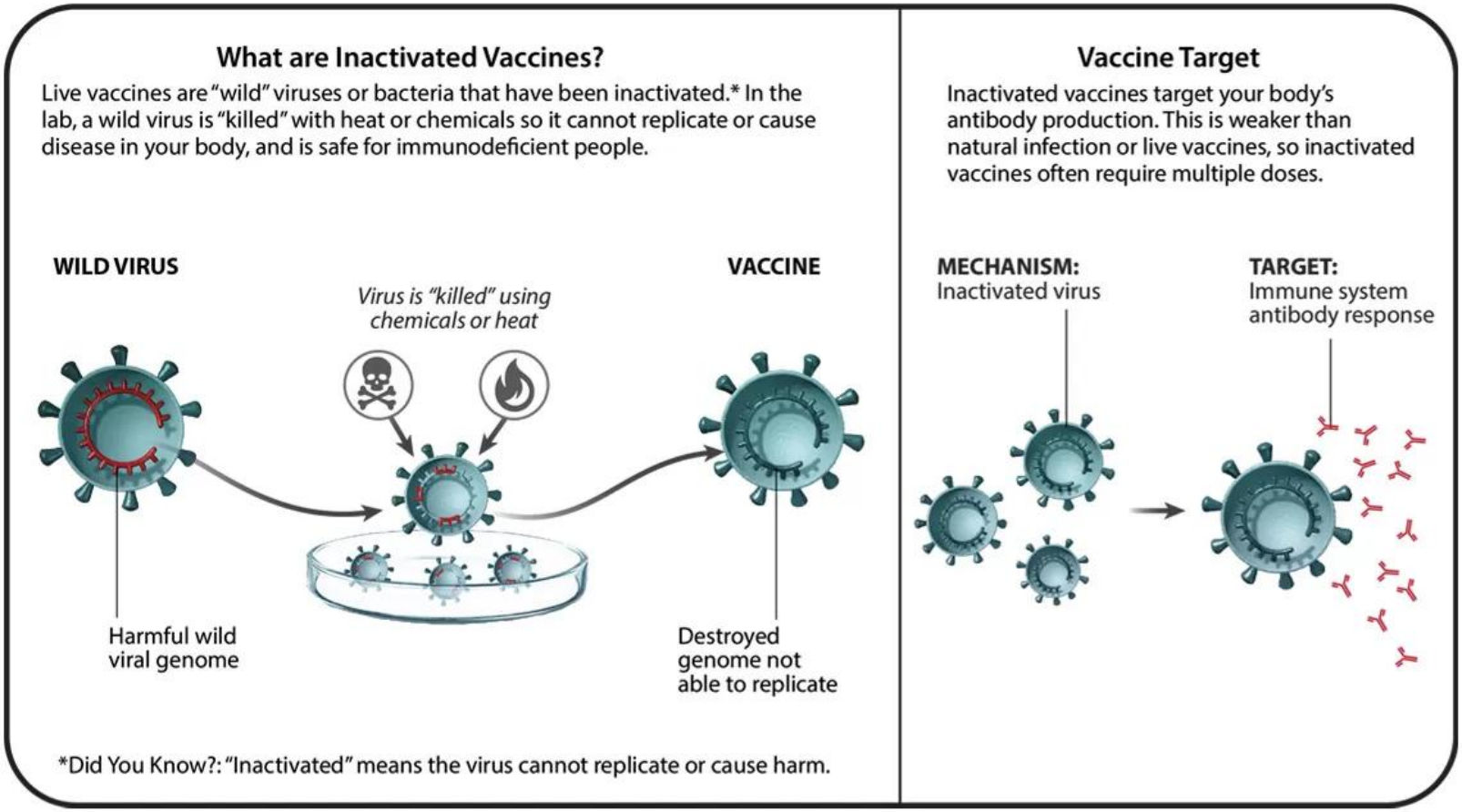
Inactivated vaccines 1

Inactivate a live pathogen or kill it. When the vaccine is then introduced to a human through a shot, for example, the inactivated pathogen is strong enough to create an immune response, however, is incapable of causing disease.

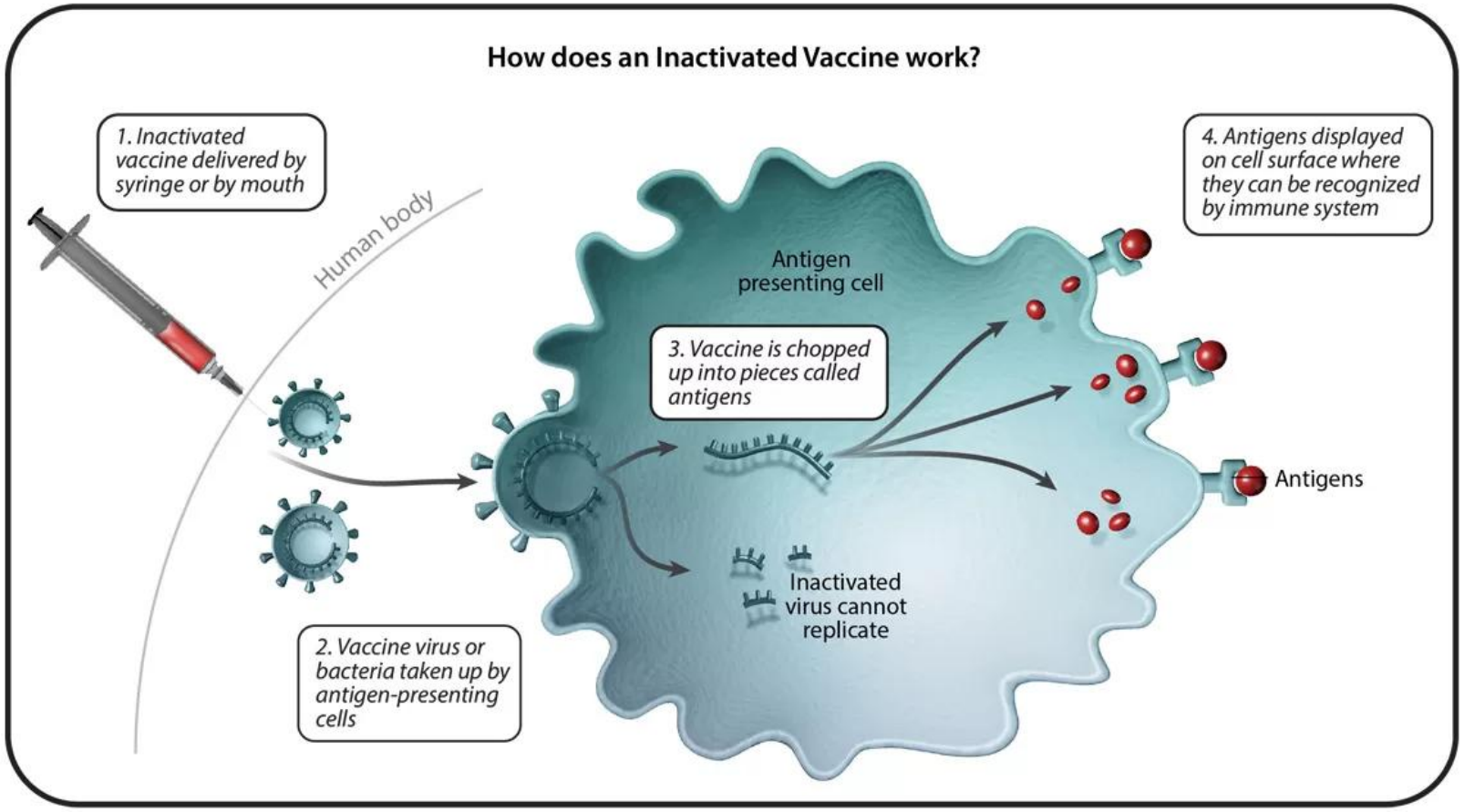
Multiple doses are often needed in order to build up immunity.

Examples: Polio vaccine, influenza vaccine

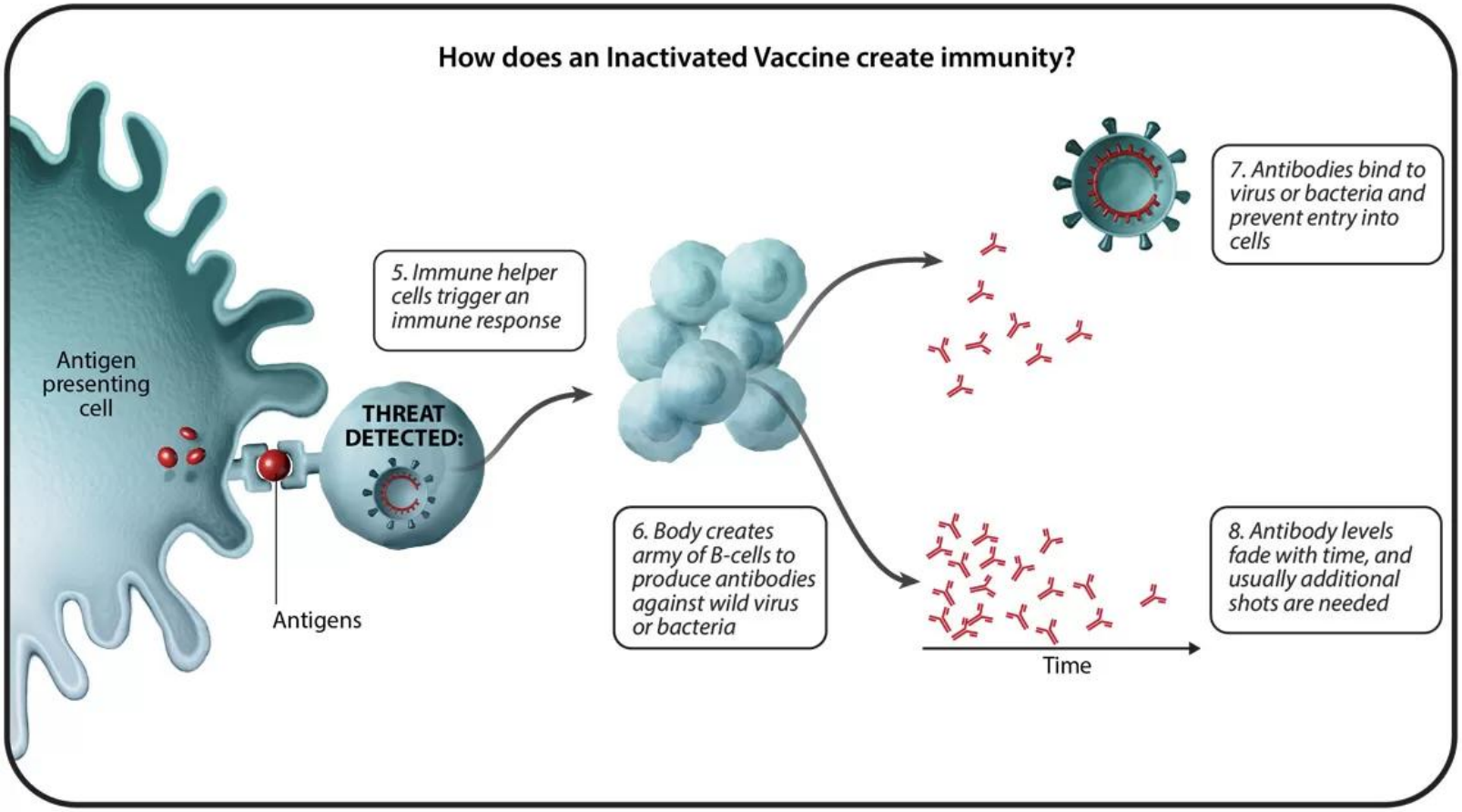
Inactivated vaccines cont2



Inactivated vaccines cont. 3



Inactivated vaccines cont. 4



- Vaccines may also contain antigens against several types (or serotypes) of the same disease-causing organism, providing protection against each type. Polio and influenza vaccines each protect against 3 types of virus, and some bacterial vaccines like pneumococcal vaccine protect against up to 23 different serotypes of Streptococcus pneumoniae.

COMMON COMBINATION PEDIATRIC VACCINE CONTAINING MULTIPLE VACCINES

(e.g. 13-valent pneumococcal conjugate vaccine),
vaccines against different disease can be combine provide protection against several different diseases:
Diphtheria, tetanus, pertussis, Heamophilus influenzae type b, Hepatitis B, and polio.
It incorporate viral and bacterial vaccines and contain toxoids, purified protein sub-unit vaccine,

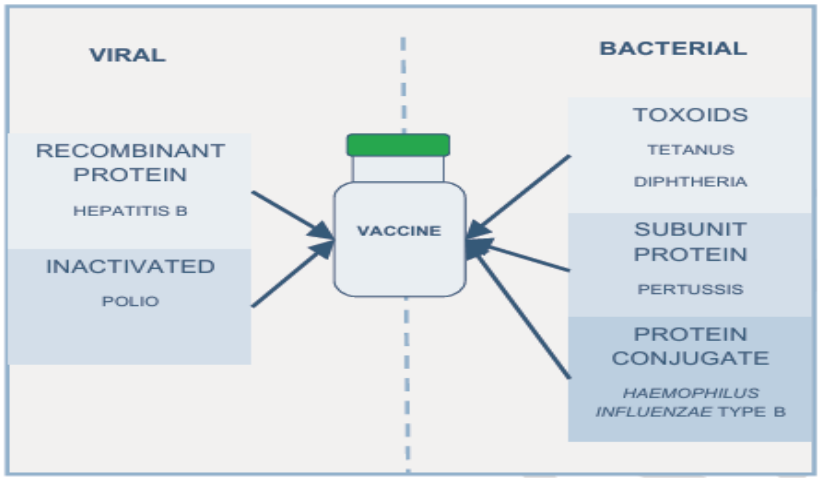


FIGURE 3. COMMON COMBINATION PEDIATRIC VACCINE CONTAINING MULTIPLE ANTIGENS OF MULTIPLE VACCINE TYPES

Administration Rote Varies

Combined vaccines, concurrent administration

- Intramuscular
  - DTaP(dipheria, Tetanus, Pertuses) HiB(hemophilus influenza), Hep B, Hep A,
- Intradermal
  - BCG
- Subcutaneous
  - MMR, Varicella, IPV
- Oral
  - OPV, Rota
- Intranasal
  - Nasal influenza vaccine

Vaccines contraindications 1

Immunisations are generally safe and effective.

- the most common reasons why it might not be advisable are:

- Severely immunocompromised individuals generally should not receive live vaccines due to the heightened risk of vaccine-derived infection.
- HIV infection, children undergoing chemotherapy or who are receiving high doses of steroids.
- If a child has previously had a severe reaction to the same vaccine.

Vaccine contraindication 2

- A known allergy to a vaccine or its components.
- Prior history of intussusception C/I for rotavirus vaccine.
- Encephalopathy within 7 days of a previous pertussis vaccine no further pertussis doses.

Are NOT contraindications to vaccination

1. Mild illness with or without fever.
2. Breast feeding.
3. Local reactions or fever after previous vaccine.
4. Preterm birth.
5. Penicillin allergy.
6. Concurrent antibiotics use.
7. Family history of seizure, controlled seizures.

General intervals between vaccines doses administration.

Antigen Combination	Recommended Minimum Interval Between Doses
2 or more inactivated[a]	May be administered simultaneously or at any interval between doses
Inactivated plus live	May be administered simultaneously or at any interval between doses
2 or more live[b]	28-day minimum interval if not administered simultaneously

General Side effects of Vaccins

- Mild version of the disease might occur after Live attenuated vaccines (e.g.MMR) usually delayed (5-7 days)
  - Local reactions to injectable vaccines (pain, swelling, redness)
  - Anaphylaxis to the vaccine or one of its components.
  - Syncope.
  - Low-grade fever up to 38°C.
- Pain, redness, or warmth at the injection site.
- Mild diarrhea.

Vaccine Complications

- Fever, fatigue, and myalgia. These symptoms are caused by the immune response, mild 1-2 day.
- Swelling and redness and localized muscle soreness may occur
- Anaphylaxis may occur after vaccination very rare.
- Guillain-Barré syndrome, very rare. affecting the peripheral nervous system.

Adjuvanted vaccines

A vaccine adjuvant is any material which is incorporated with a vaccine for the purpose of enhancing the immune response. have a higher, earlier, and longer-lasting immune response.

In most of vaccines its Aluminum salts.

ADJUVANTED VACCINE
(in most vaccines its Aluminum salt)

Adjuvanted Vaccine	Type of Adjuvant
Hepatitis A	Aluminum salt
Hepatitis B	Aluminum salt
Diphtheria, Tetanus, acellular Pertussis combinations (DTaP or Tdap)	Aluminum salt
Haemophilus influenzae type b (Hib)	Aluminum salt
Human Papilloma Virus (HPV)	Aluminum salt *or* AS04 (aluminum salt and monophospholipid A)
Pneumococcal conjugate	Aluminum salt
Japanese encephalitis	Aluminum salt
H1N1 influenza	MF59 (oil in water emulsion) [one vaccine]

TABLE 3. EXAMPLES OF ADJUVANTED VACCINES[2]

FIGURE 4. THE IMMUNE RESPONSE TO Infection TO versus VACCINE

DISEASES-CAUSING ORGANISM

Vaccine

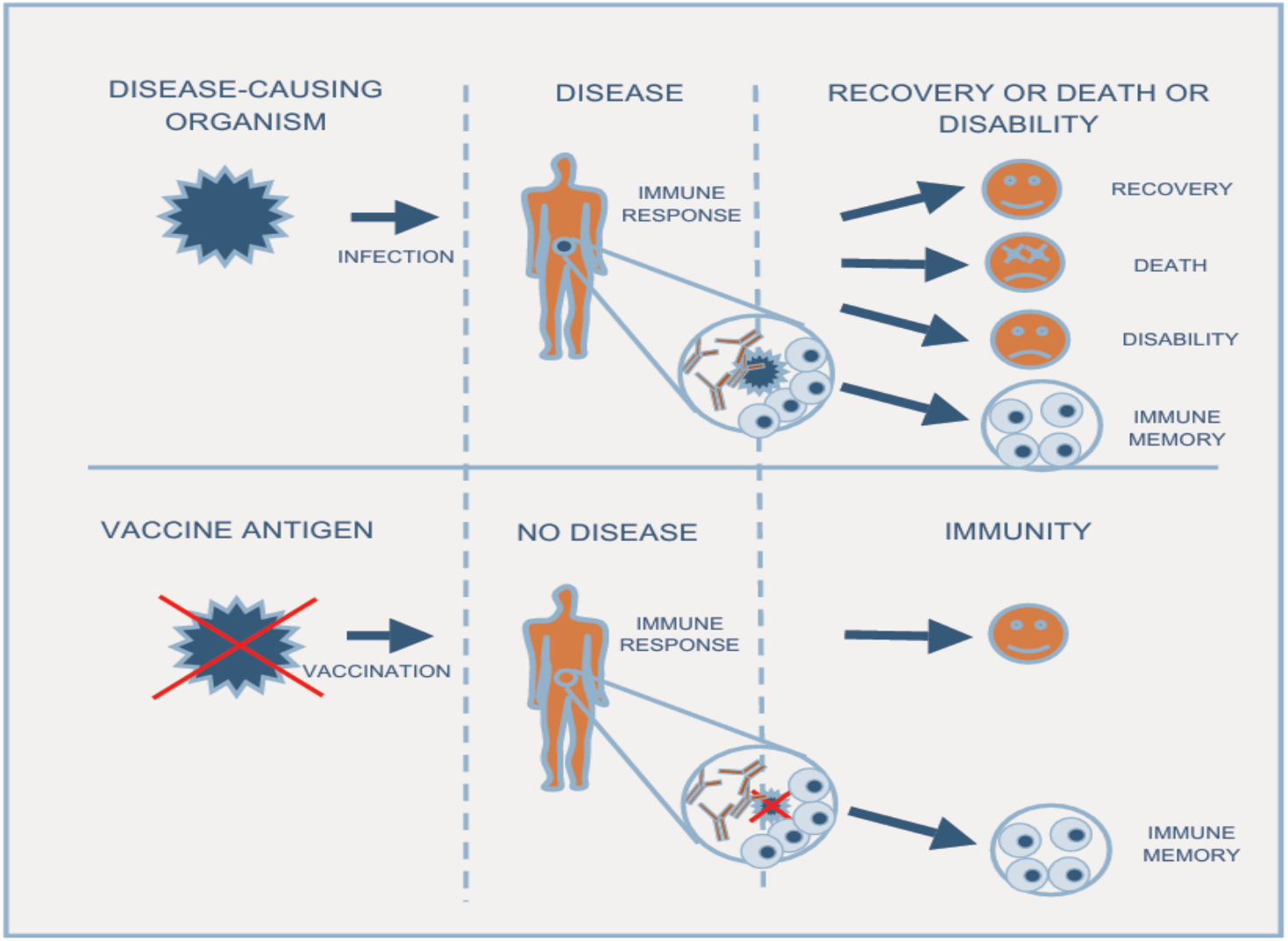


FIGURE 4. COMPARISON OF THE IMMUNE RESPONSE TO A DISEASES-CAUSING ORGANISM AND TO A VACCINE

Influenza annual vaccination new strains

- Some disease-causing organisms, as influenza, change from year to year, requiring annual immunization against new strains.
- In very young children, the immune system is immature and less capable of developing memory. In this age group, duration of protection can be very short-lived for polysaccharide antigens.

National Immunization Program in Jordan

- Vaccination in Jordan is mandatory for all children.
- Achieved a high 95% coverage rate.
- Ministry of Health (MoH), supported by WHO and UNICEF, provides free routine vaccines against 12 diseases.

Immunization schedule In Jordan & by WHO

BCG	birth-6 years
DT	3, 4, 5, 18 months (high-risk groups)
DTaPHibIPV	3, 4, 5 months
DTwP	18 months
DTwPHib	5 months
DTwPHibHep	3, 4 months
HepB	3, 4, 5 months
Influenza	health workers; pilgrims; high-risk groups
IPV	3, 4 months
Measles	9 months
MenACWY	>2 years; pilgrims; high-risk groups
MMR	12, 18 months
OPV	4, 5, 9, 18 months; 6 years
Pneumo_conj	3, 5, 9 months (subnational)
Td	6, 16 years
TT	1st contact; +1, +6 months; +1 year, +1 year
Typhoid	travellers

At One month

Bacille Calmette-Guerin vaccine (BCG)

Live attenuated vaccine, its created using

A weakened living strain of Mycobacterium Bovis.

(bacterium closely related to the one that causes tuberculosis (TB).

At 3 months of age

Hexaxim vaccine (Hexa) - first dose

Inactivated poliovirus vaccine (IPV)

Diphtheria(toxoid), Tetanus, and Pertussis .

Haemophilus influenzae vaccine B, Hepatitis B.

ROTA vaccine - first dose

At 4 months of age

Hexaxim vaccine (Hexa) - second dose

Inactivated poliovirus vaccine (IPV)

Diphtheria, Tetanus, and Pertussis vaccine (DaPt)

Haemophilus influenzae vaccine, type B

Hepatitis vaccine, type B

ROTA vaccine - second dose

Oral Polio Vaccine (OPV) - first dose

At 5 months of age

Hexaxim vaccine (Hexa) - third dose

Inactivated poliovirus vaccine (IPV)

Diphtheria, Tetanus, and Pertussis vaccine (DaPt)

Haemophilus influenzae vaccine, type B

Hepatitis vaccine, type B

ROTA vaccine - third dose

Oral Polio Vaccine (OPV) - second dose

At 10 months of age

Measles vaccine

Oral Polio Vaccine (OPV) - third dose

Vitamin A (100 thousand international units)

At 1 year of age

Measles, Mumps, and Rubella (German measles) Vaccine (MMR-1) - first dose

At 18 months of age

Measles, Mumps, and Rubella (German measles) Vaccine (MMR-2) - second dose

Diphtheria, Tetanus, and Pertussis vaccine (DaPt) - the supportive dose

Oral Polio Vaccine (OPV)

the supportive dose Vitamin A (200 thousand international units)

THANK YOU