UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

# VACCINATIONS

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Vaccinations save lives annually 6 million people, including 3 million children.

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Vaccinations have revolutionized the prevention, medicine and modern civilizations.

Morbidity and mortality due to such diseases as diphtheria, measles and polio have been reduced in many countries by about 99%.

The biggest impact on the success of vaccination has mass-performance (high state immunization).

*UK Department of Health. The Green Book. 2006.*

# Uses of Vaccines

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

| Prevent Infecion | Polio |
|---|---|
| Control existing infection | Zoster |
| Prevent disease development post-exposure | Rabies |
| Prevent fetal infection | Rubella |
| Prevent or control cancer | HPV/HBV |

# Inactivated vaccines and live, attenuated vaccines

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

**Inactivated vaccines**

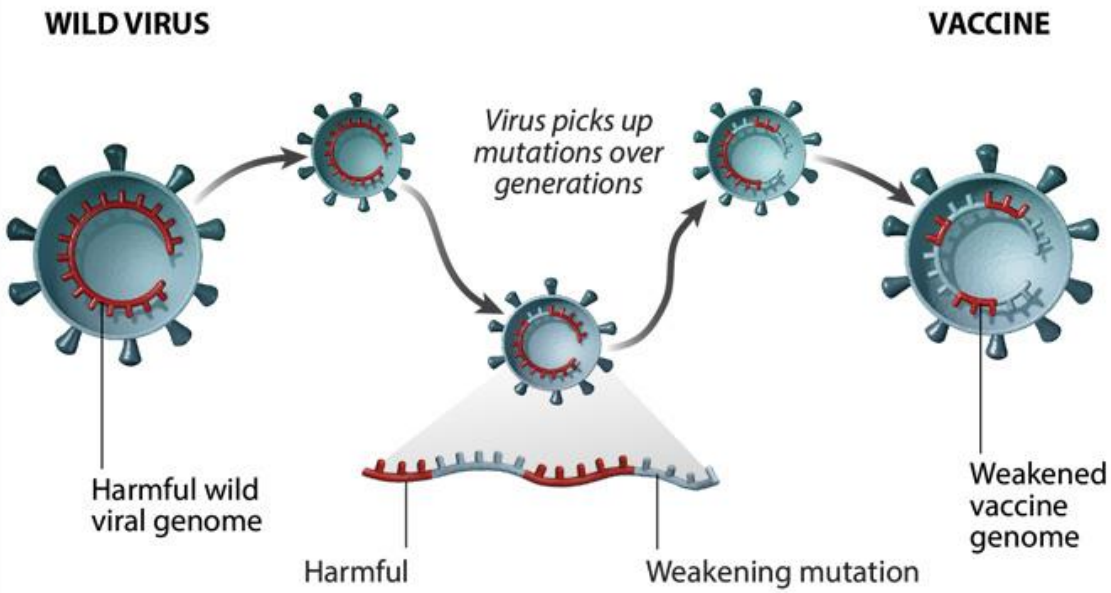
Acellular pertussis
Cholera and travellers' diarrhea
Diphtheria toxoid
*Haemophilus influenzae* type b (Hib)
Hepatitis A
Hepatitis B
Human papillomavirus (HPV)
Inactivated poliomyelitis
Japanese encephalitis
Meningococcal
Pneumococcal
Rabies
Tetanus toxoid-
Tick-borne encephalitis
Trivalent inactivated influenza (TIV)
Typhoid (injectable formulation)

**Live, attenuated vaccines**

Bacillus Calmette-Gérin (BCG)
Herpes Zoster (shingles)
Live attenuated influenza (LAIV)
Measles
Mumps
Rotavirus
Rubella
Smallpox
Typhoid (oral formulation)
Varicella (chickenpox)
Yellow fever

## What are Live, Attenuated Vaccines?

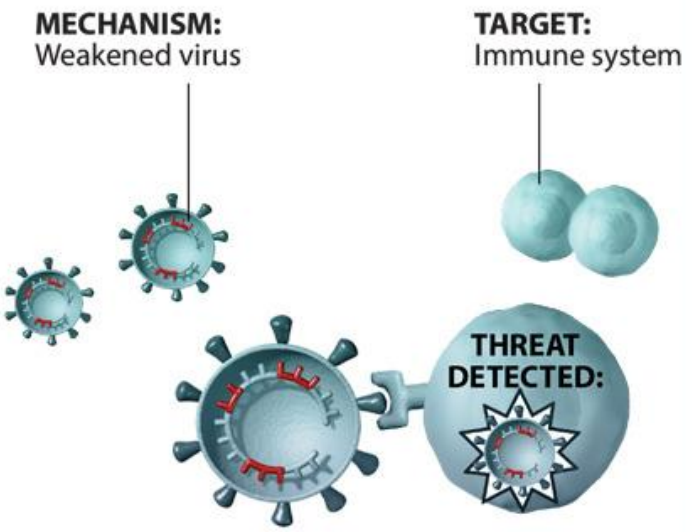
Live vaccines are "wild" viruses or bacteria that have been weakened.* In the lab, generally the virus is passed through many generations of cells to pick up genetic mutations which weaken it - so much it won't cause disease in your body.




*Did You Know?: "Attenuated" means weakened.

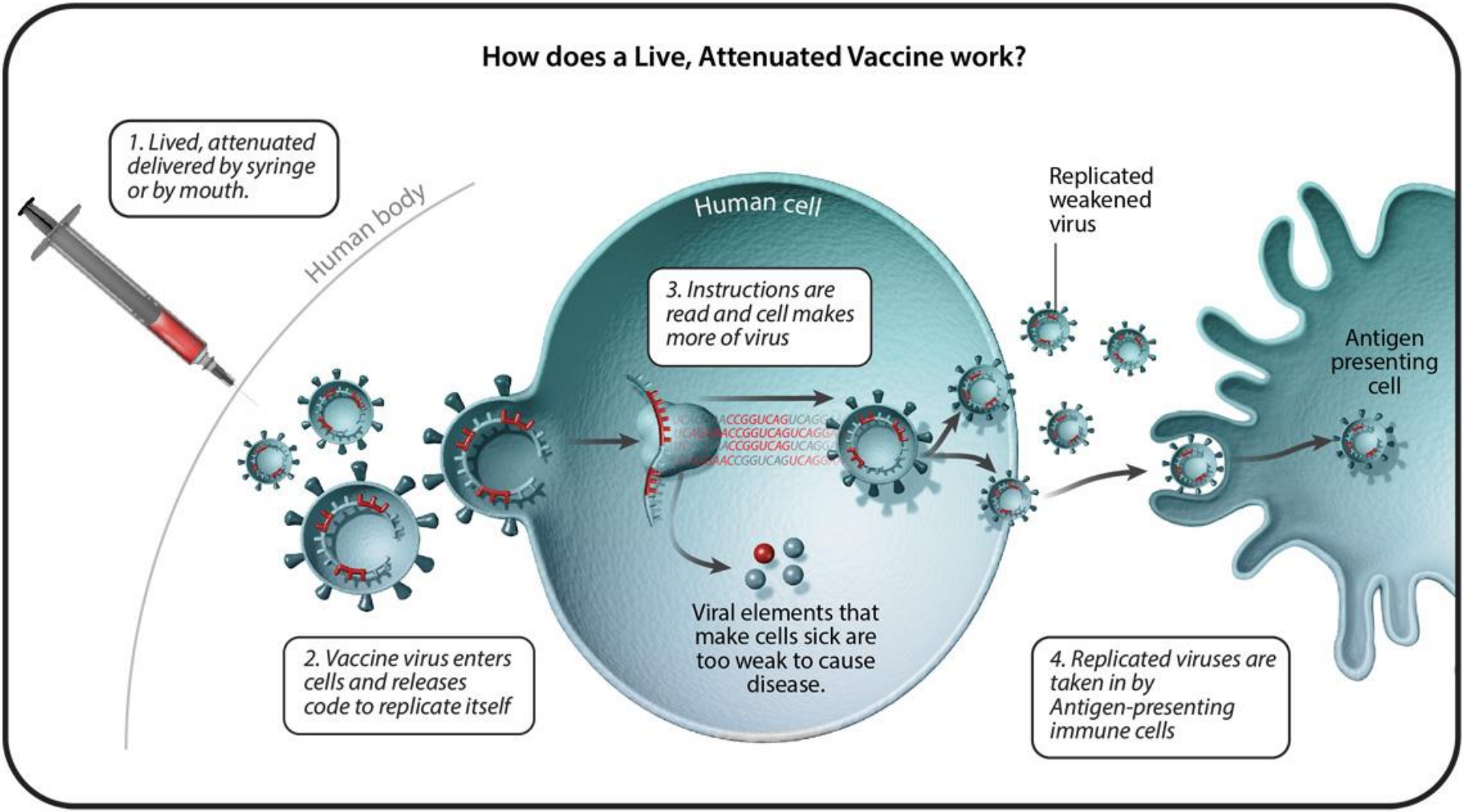
## Vaccine Target

Live, attenuated vaccines target your body's immune system directly. They are strong enough to trigger the immune response, but too weak to cause disease.



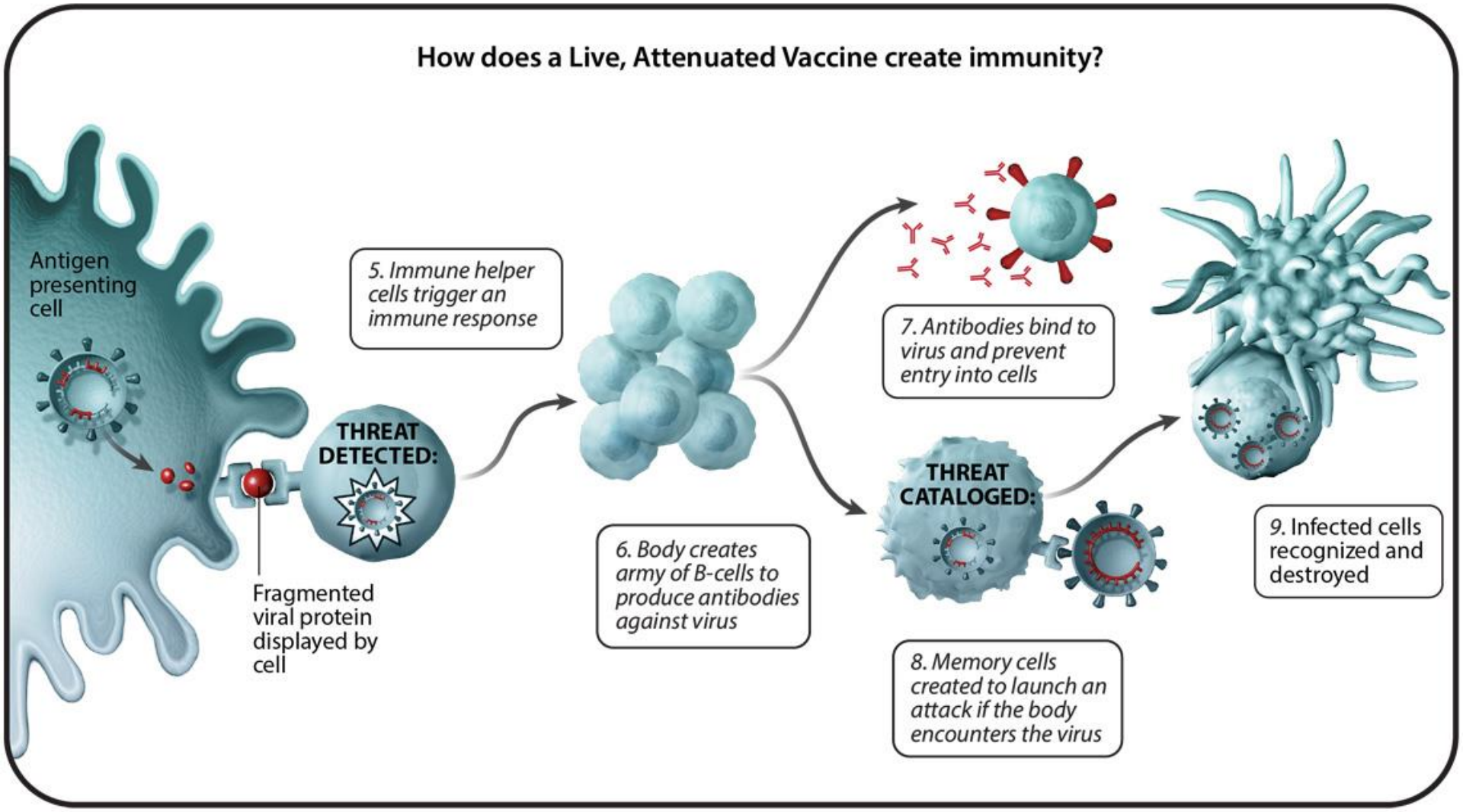



https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT






https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT




**Benefits:** Because these types of vaccines contain a live pathogen, the immune system reacts very well to them and it will typically remember the pathogen for a very long time. Additional doses, or booster shots, are not always needed.

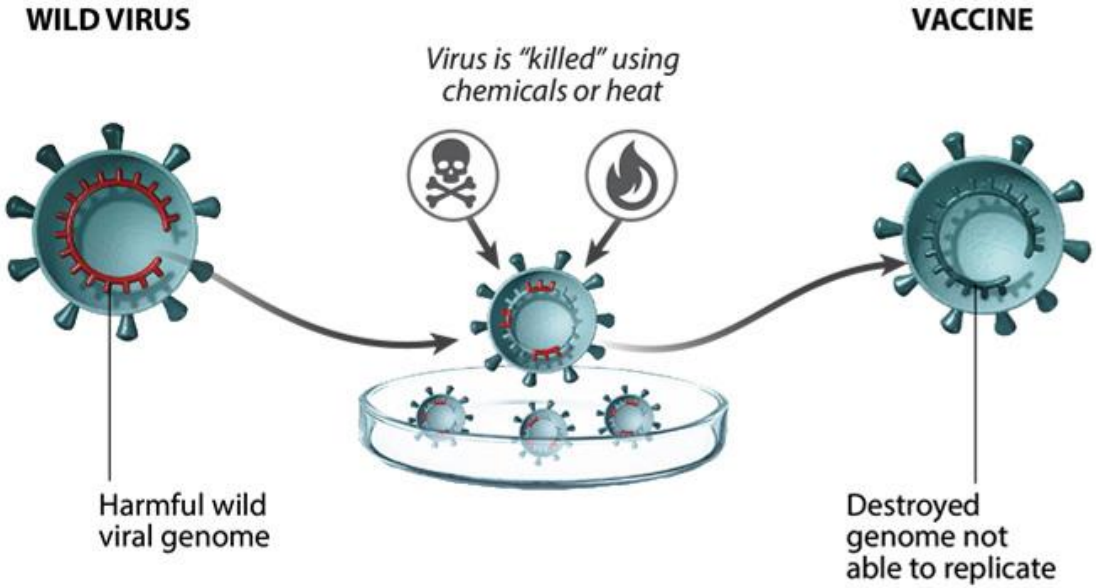
**Examples:** Measles, mumps, and rubella (MMR) vaccine, varicella (chickenpox) vaccine



https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT

## What are Inactivated Vaccines?

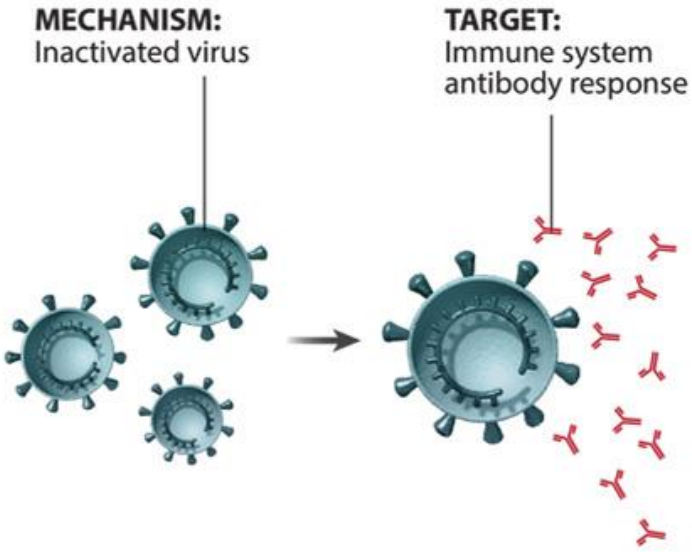
Live vaccines are "wild" viruses or bacteria that have been inactivated.* In the lab, a wild virus is "killed" with heat or chemicals so it cannot replicate or cause disease in your body, and is safe for immunodeficient people.




*Did You Know?: "Inactivated" means the virus cannot replicate or cause harm.

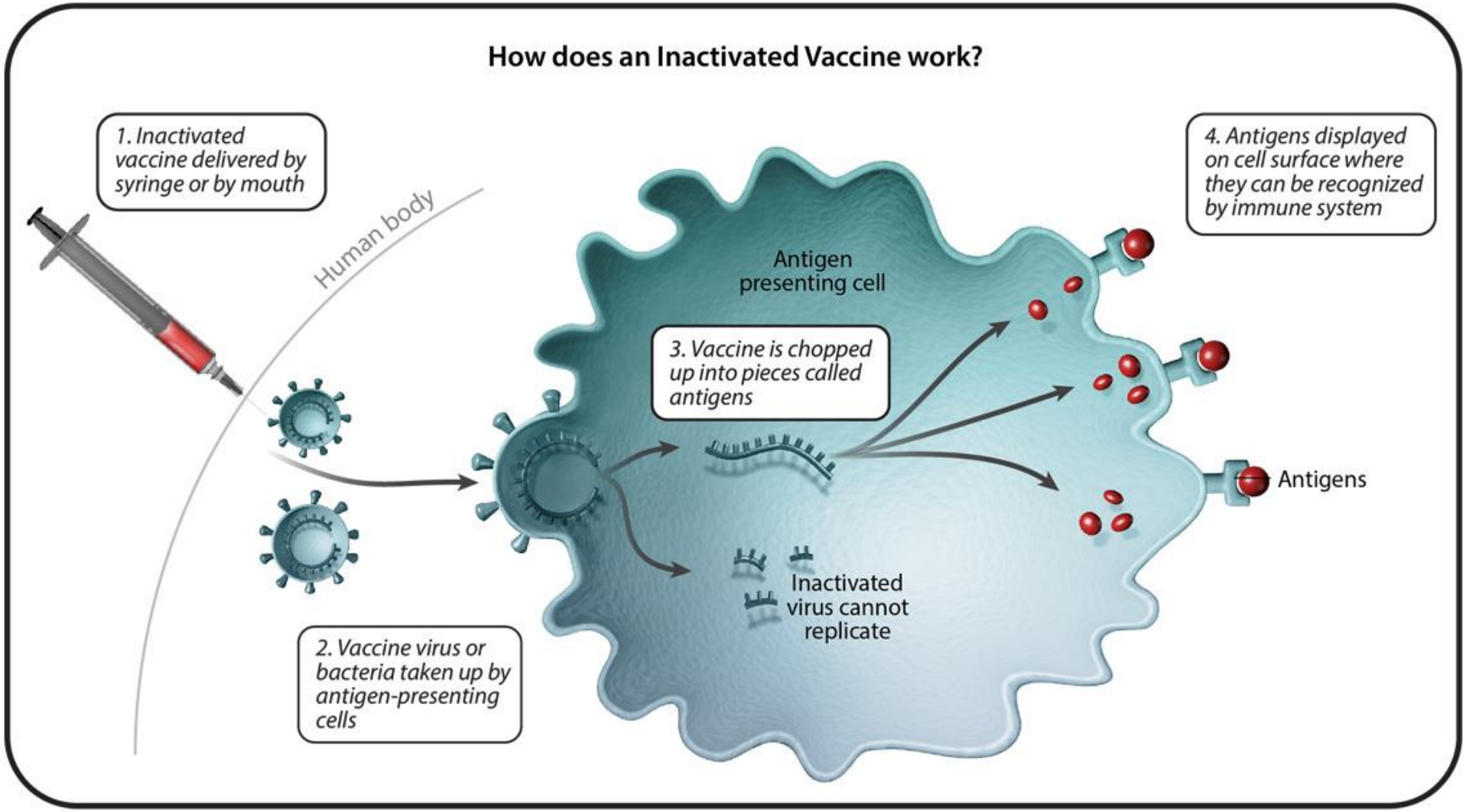
## Vaccine Target

Inactivated vaccines target your body's antibody production. This is weaker than natural infection or live vaccines, so inactivated vaccines often require multiple doses.



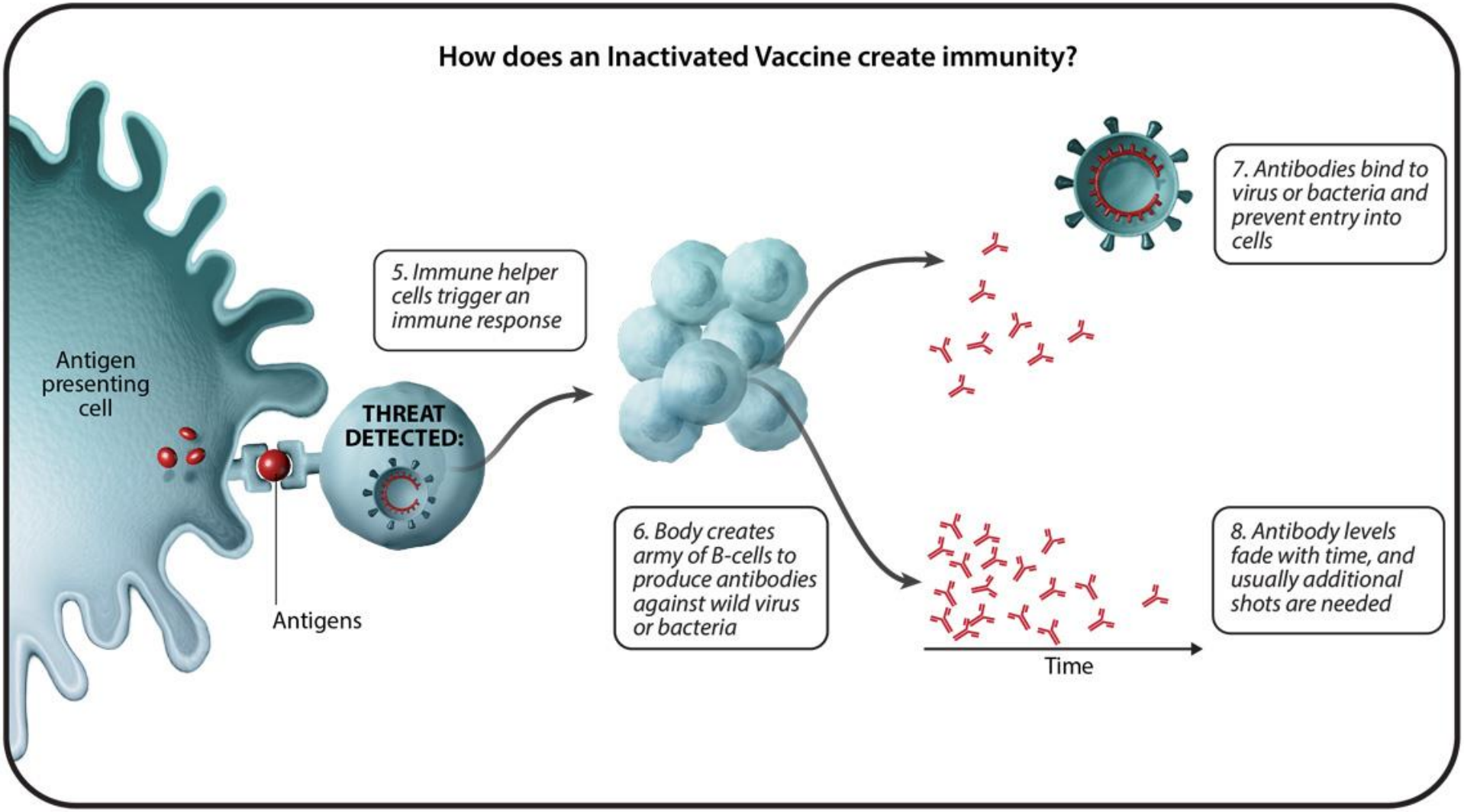



https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT






https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT




**Benefits:** Inactivated vaccines can be mass-produced and are relatively inexpensive to make.

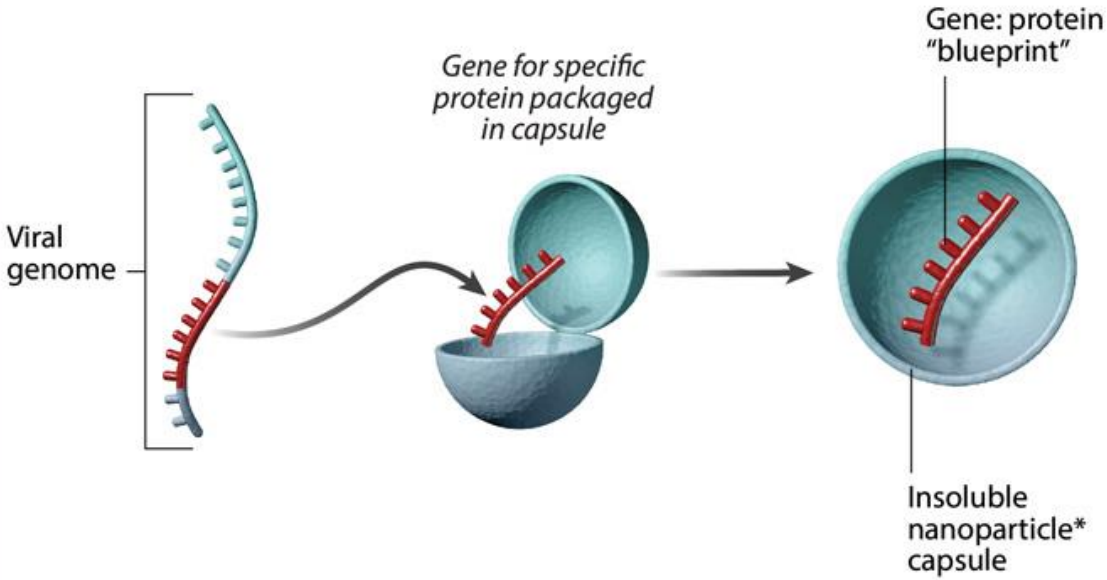
**Examples:** Polio vaccine, influenza vaccine



https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT

## What is the Messenger RNA (mRNA) vaccine?

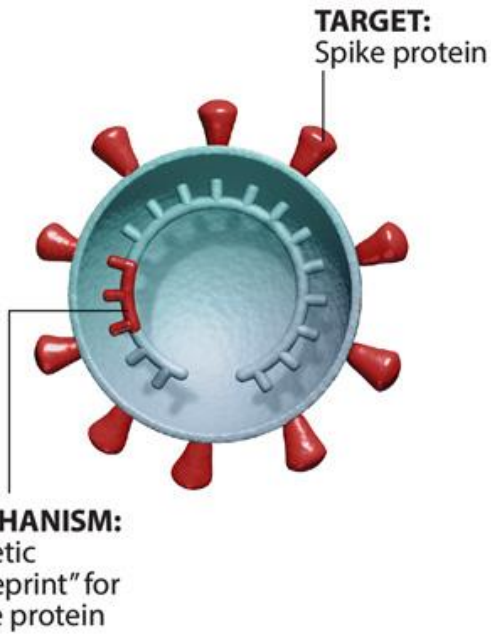
Made of a small section of a virus' genetic material - the instructions or 'blueprint' for a specific protein. A insoluble nanoparticle* capsule carries the gene safely to your cells.




*Did You Know?: "Nano" means small.

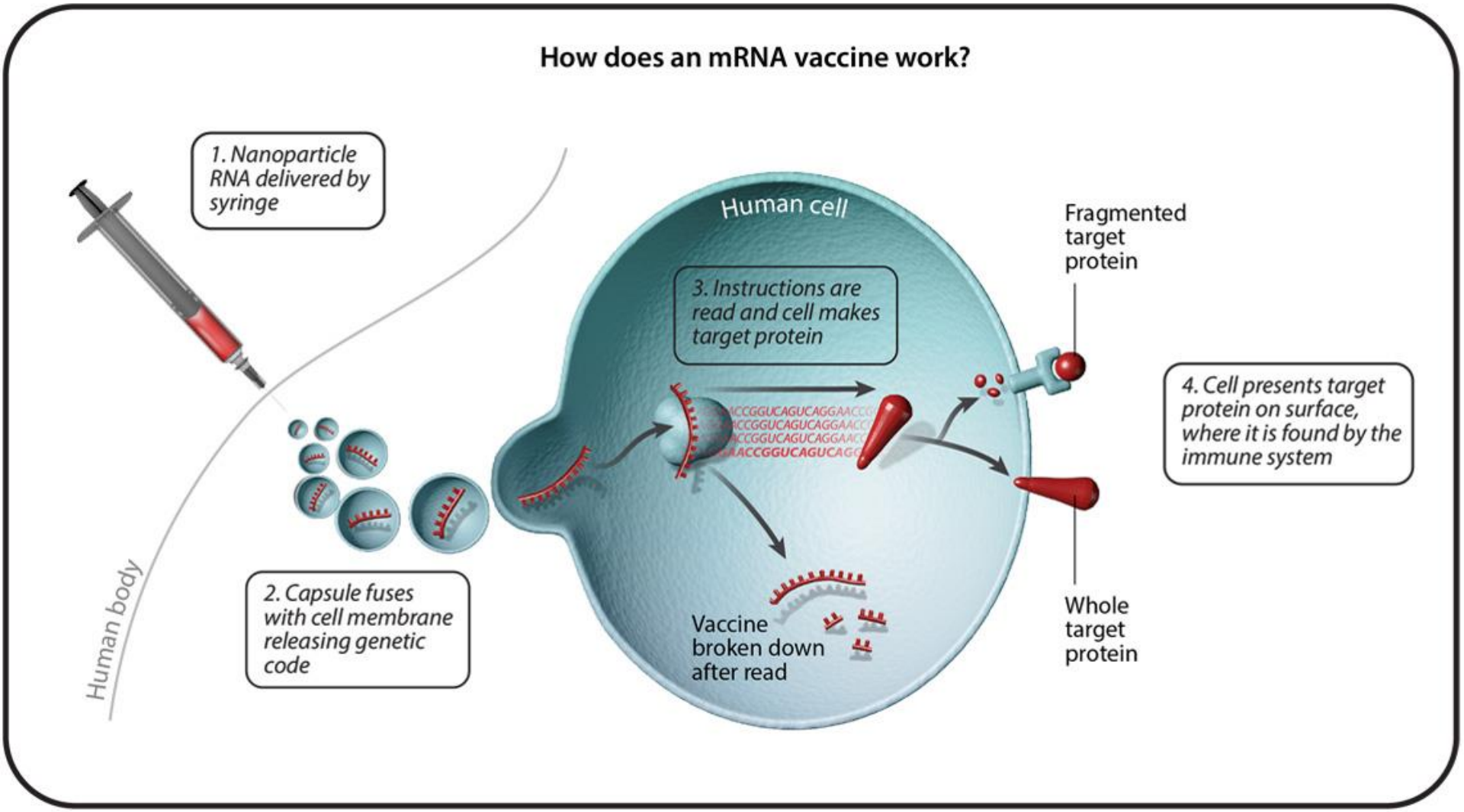
## Vaccine Target

Pfizer's mRNA COVID vaccine carries the genetic blueprint for the spike protein. Your body will make this protein and build immunity against any invaders carrying it on their surface.



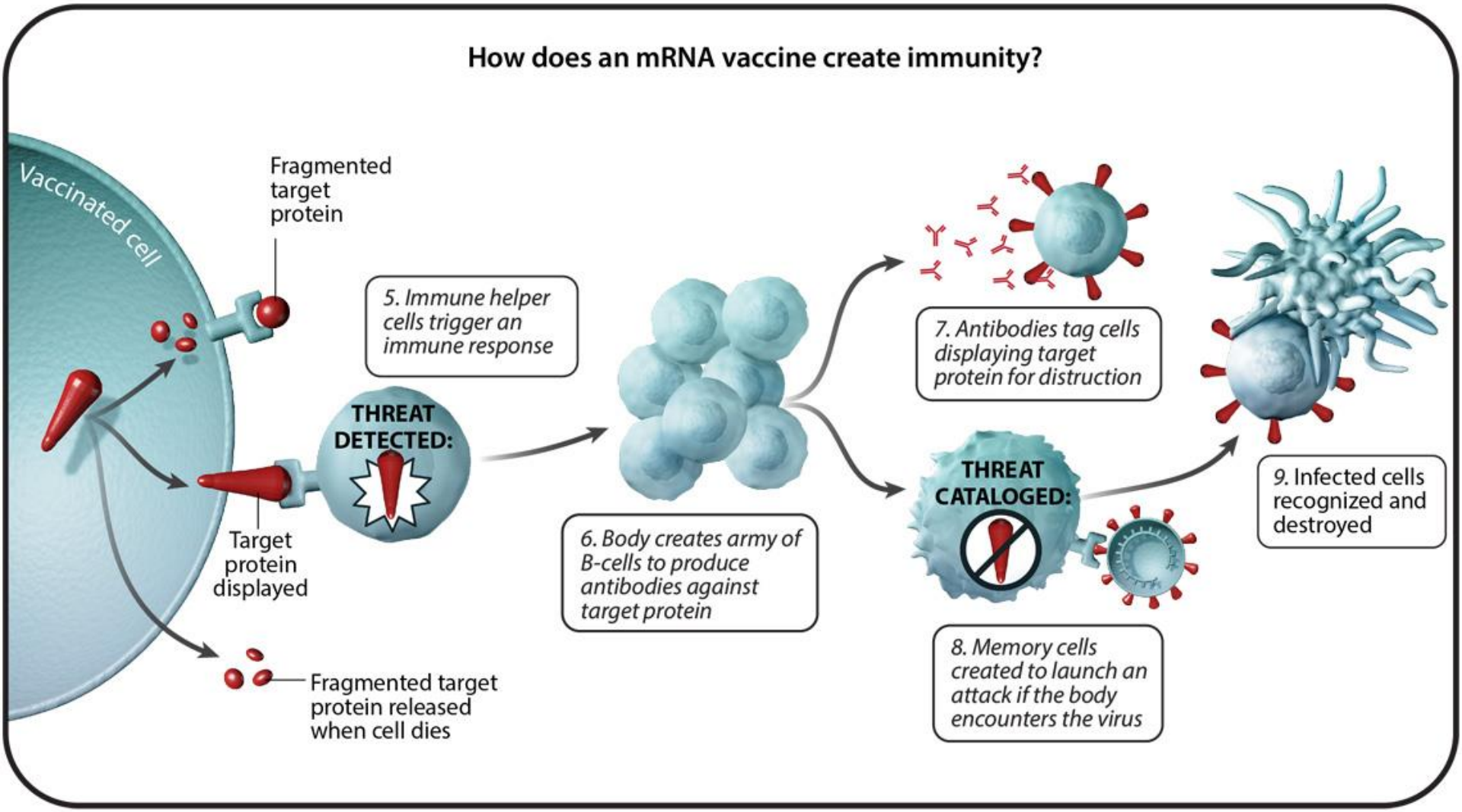



https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT






https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT




**Benefits:** "It is a very powerful technique to be able to create a lot of a vaccine fast. The benefit is that the technology is very adaptable. We can potentially go in and change the mRNA in the formulation to target a new antigen and can make a lot of high-quality vaccine material relatively quickly."



**Examples:** Pfizer-BioNTech COVID-19 vaccine

https://cdn.pfizer.com/pfizercom/2022-03/2-live-attenuated-vaccine-01_1140X675_0.jpg?G7PIahdh2k7UNyCaLnFvxXMCCPJk1DsT

# Advantages and disadvantages of live attenuated vaccines

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

| Adavntages | Disadvantages |
|---|---|
| - Mimic natural infection thus providing appropiate responses<br><br>- Stimulated both humoral and cell-mediated responses<br><br>- Typically generate long-term immunity with reduced need for booster immunization | - Slight potential to revert back to virulent form<br><br>- Often require refigeration<br><br>- Potential for spread from vaccine<br><br>- Contraindicated in immunocopmpromised due to risk of significant pathology |

# Advantages and disadvantages of inactivated vaccines

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

| Advantages | Disadvantages |
|---|---|
| - Relatively easy to manufacture<br>- No possibility of reversion to virulent pathogen<br>- Safe for use in the immunocompromised | - Adjuvants required<br>- Typically requires initial 2-3 immunizations and then relatively frequent boosts<br>- Immunity can be short-lived and predominantly humoral with poor cell-mediated immunity |

# ADJUVANTS

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

**Adjuvants are substances that help immune system respond more strongly to a vaccine. This increases immunity against the disease.**

Examples include:

- Aluminum salts: aluminium hydroxide, aluminium phosphate, alum (pottasium aluminium sulfate), or mixed aluminium salts
- AS03: oil-in-water emulsion containing D-, L-alha-tocopherol and squalene
- AS04: aluminium hydroxide and monophosphoryl lipid A (a low-toxicity derivative of LPS which stimulates TLR4)
- MF59: oil-in-water emulsion of squalene
- Virosomes: double membrane lecithin-phospholipid liposomes (incorporating viral proteins)

# Why is aluminum in some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Aluminum salts are incorporated into some vaccine formulations as an adjuvant. An adjuvant is a substance added to some vaccines to enhance the immune response of vaccinated individuals.

Aluminum adjuvant containing vaccines have a demonstrated safety profile of over six decades of use and have only uncommonly been associated with severe local reactions. A study conducted by FDA determined that the risk to infants posed by the total aluminum exposure received from the entire recommended series of childhood vaccines over the first year of life is extremely low.

# Why are antibiotics in some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Certain antibiotics may be used in some vaccine production to help prevent bacterial contamination during manufacturing. As a result, small amounts of antibiotics may be present in some vaccines.

Antibiotics most likely to cause severe allergic reactions (e.g., penicillins, cephalosporins, and sulfa drugs) are not used in vaccine production and, therefore, are not contained in vaccines.

Antibiotics used during vaccine manufacture include neomycin, polymyxin B, streptomycin, and gentamicin.

# Why is formaldehyde in some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Formaldehyde has a long history of safe use in manufacturing certain viral and bacterial vaccines. It is used to inactivate viruses so they don't cause disease (e.g., polio virus used to make polio vaccine) and to detoxify bacterial toxins, such as the toxin used to make diphtheria vaccine.

Formaldehyde is diluted during the vaccine manufacturing process, but residual quantities of formaldehyde may be found in some current vaccines.

The amount of formaldehyde present in some vaccines is so tiny compared to the concentration that occurs naturally in the body that it does not pose a safety concern.

# Why is formaldehyde in some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Formaldehyde is also produced naturally in the human body as a part of normal functions of the body to produce energy and build the basic materials needed for important life processes. This includes making amino acids, which are the building blocks of proteins that the body needs.

Formaldehyde is also found in the environment and is present in different ways. It is used in building materials, as a preservative in labs and to produce many household products.

# Why is formaldehyde in some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

The amount of formaldehyde in a person's body depends on their weight; babies have lower amounts than adults. Studies have shown that for a newborn of an average weight of 6 - 8 pounds, the amount of formaldehyde in their body is 50-70 times higher than the amount that they could receive from a single dose of a vaccine or from vaccines administered over time.

# Why are sugars, amino acids, and proteins added to some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

These substances may be added as stabilizers. They help protect the vaccine from adverse conditions, such as the freeze-drying process, for those freeze-dried vaccines. Stabilizers added to vaccines include sugars such as sucrose and lactose, amino acids such as glycine or the monosodium salt of glutamic acid, and proteins such as human serum albumin or gelatin. Sugars, amino acids, and proteins are not unique to vaccines; they are naturally encountered in everyday life in the diet and are components of the body.

# Why are there preservatives in some vaccines?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Preservatives are added to some vaccine formulations to prevent the growth of bacteria or fungi that may be introduced into the vaccine during its use, e.g., repeated puncture of a multi-dose vaccine vial with a needle.

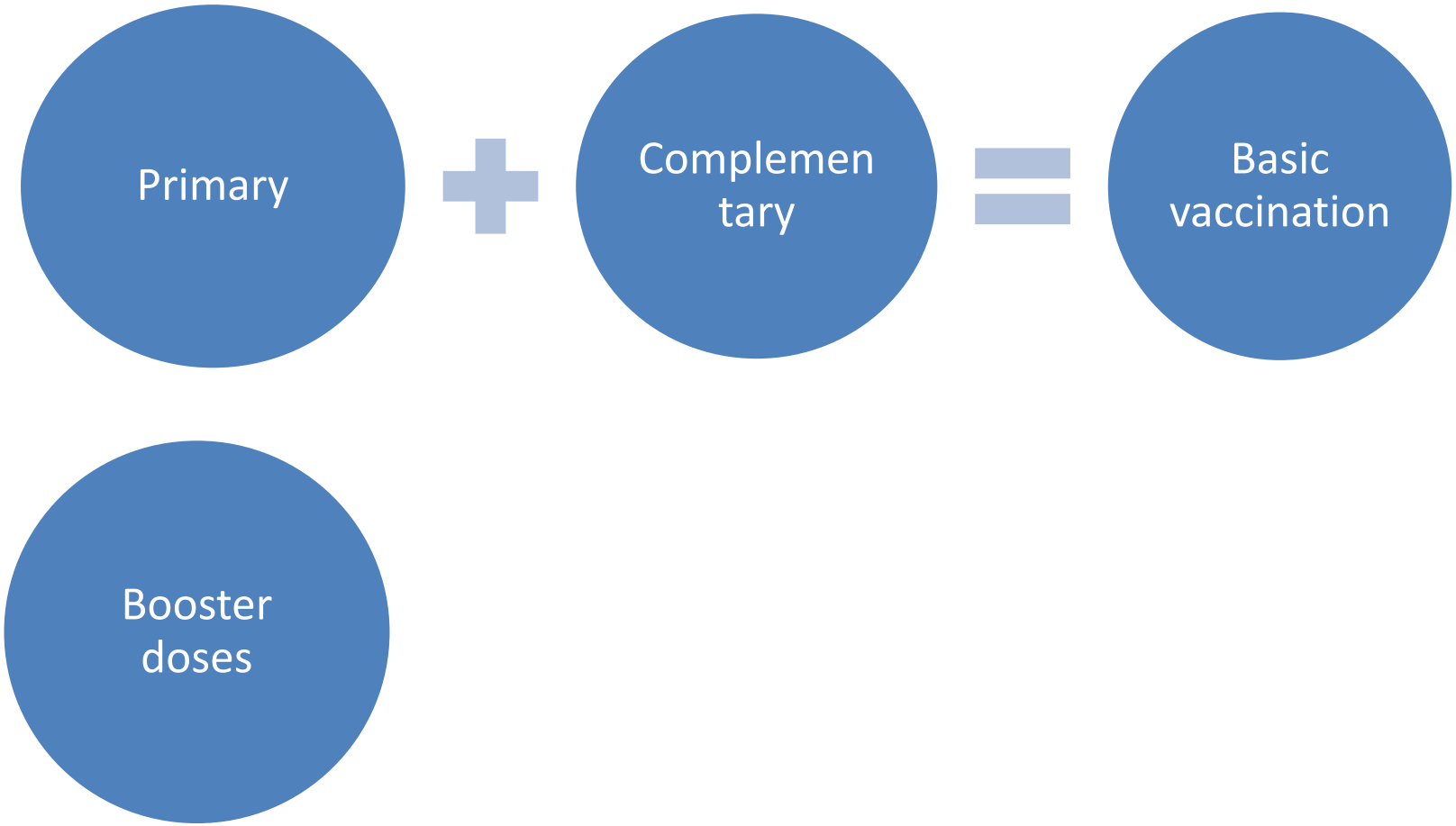
# Guidelines for spacing of live and non-live antigens

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

| Antigen combination | Recommended minimum interval between doses |
|---|---|
| Two or more non-live[a],[b],[c] | May be administered simultaneously or at any interval between doses |
| Non-live and live[d] | May be administered simultaneously or at any interval between doses |
| Two or more live injectable[d] | 28 days minimum interval, if not administered simultaneously |



https://www.cdc.gov/vaccines/hcp/acip-recs/general-recs/timing.html#t-01


Primary
Complementary
Basic vaccination
Booster doses

- all vaccines require a primary dose or series to ensure immunity

- some require periodic repeat, or booster doses to maintain immunity

# Combination vaccine

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

There are three different types of vaccine preparations based on how many and what types of immunizing antigens are contained in the vaccine:

- vaccines containing only one immunizing antigen against one disease (e.g., hepatitis A vaccine)
- vaccines containing immunizing antigens against more than one serogroup or serotype of the same disease (e.g., meningococcal vaccine, pneumococcal vaccines)
- vaccines containing immunizing antigen against more than one vaccine preventable disease (e.g., measles-mumps-rubella vaccine)

# The benefits of combination vaccines:

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- improved adherence to immunization schedules because of a reduction in the number of immunization visits and injections required, leading to improved vaccine coverage rates

- increased opportunity for administration of catch-up or booster doses

- reduced stress for vaccines and vaccine providers related to multiple injections of separate vaccines

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

**CDC recommends all women receive a Tdap vaccine during the 27th through 36th week of *each* pregnancy, preferably during the earlier part of this time period.**

About 7 in 10 deaths from whooping cough are among babies younger than 2 months old. These babies are too young to receive a Tdap vaccine. The younger the baby is when they get whooping cough, the more likely they will need to be treated in a hospital.

# Vaccines During and After Pregnancy

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

When a pregnant person gets a whooping cough vaccine during pregnancy, her body will create protective antibodies and pass some of them to the baby before birth. These antibodies will provide the baby some short-term, early protection against whooping cough.

# Vaccines During and After Pregnancy- FLU VACCINE

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

The CDC and the American College of Obstetricians and Gynecologists (ACOG) recommend that women who are pregnant during flu season (October through May) get the flu vaccine. The CDC also recommends getting the shot by the end of October—before the flu season takes hold.

Flu vaccine is safe during pregnancy and can be given during any trimester.

# Vaccines During and After Pregnancy- FLU VACCINE

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Women who are pregnant can have changes in their immune system and in their heart and lung functions—this can increase their risk for getting seriously ill from the flu. Moreover, getting the flu can result in serious problems for the unborn baby. These may include premature labor and delivery.

Getting a flu shot during flu season while pregnant may not only help protect the mother from getting the flu, it may also help protect her baby from complications from the flu for several months after he or she is born.

Babies younger than 6 months old are too young to be vaccinated against the flu.

When during pregnancy should a person get a COVID-19 vaccine? CDC and professional medical organizations, including the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine, **recommend COVID-19 vaccination at any point in pregnancy, as well as booster doses for those eligible**.

# Influenza vaccination

# Influenza vaccination

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Influenza is a vaccine preventable disease and influenza vaccines have been available for use in Europe since the 1960s
- A number of variants of the influenza viruses co-circulate each year
- Individuals can develop immunity to the different subtypes of influenza viruses, but there is little cross-immunity between subtypes
- This is why several influenza strains must be included into combination vaccines
- Currently all influenza vaccines contain four different influenza subtypes : two influenza A subtypes (H1N1, H3N2) and two influenza B subtypes

# Influenza vaccination

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- An update of seasonal influenza vaccines is needed regularly since influenza viruses constantly evolve and sometimes recombine
- The match between the selected vaccine viruses and circulating viruses influences vaccine effectiveness and may, therefore, vary from year to year
- To overcome this, the precise vaccine viruses selected are reviewed annually by a strain selection meeting convened each year in February by the World Health Organization (WHO)

# Risk groups

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

The **Influenza Risk Groups** are people who (when infected) are more likely than others to develop severe disease

- Older adults
- All persons (over six months of age) with chronic conditions

# Risk groups

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- respiratory system e.g. asthma
- cardiovascular system e.g. coronary artery disease
- endocrine system e.g. diabetes
- hepatic system e.g. cirrhosis
- renal system e.g. chronic renal failure
- neurological / neuromuscular conditions e.g. parkinsonism.

# Risk groups

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- any condition compromising respiratory functions e.g. obesity
- immunosuppression due to disease or treatment including due to haematological conditions and HIV infection
- pregnant women

# Vaccination against pneumococcal disease

# Vaccination against pneumococcal disease

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Despite good access to effective antibiotics, *Streptococcus pneumoniae* (pneumococci) is still a major cause of disease and death in both developing and developed countries.
- Pneumococci are the main cause of bacterial respiratory tract infections, such as pneumonia, middle ear infection, and sinusitis, in all age groups.
- The youngest and the elderly are those most prone to invasive pneumococcal infections, such as severe blood infection, meningitis and pneumonia.
- Carriage of pneumococci without symptoms in the nose of young children is common

# Types of vaccines against pneumococcal disease

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- PCV 13- A new generation of (conjugated) vaccines appears to be highly efficient against invasive disease and it also prevents nasopharyngeal carriage. These vaccines cover the types of the bacteria commonly seen in childhood invasive disease and also those associated with antimicrobial resistance.

- PPSV23- Polysaccharide vaccines are registered throughout the world. They protect against invasive pneumococcal disease in adults. Such vaccines, instead, have little effect in children under five years of age and do not prevent the carriage without symptoms

# Prevenar-13 (PCV-13) Conjugate Vaccine

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Children receive multiple doses of the pneumococcal vaccine (2, 4, 6, and 12 through 15 months old).
- Adults only get a single dose.
- The vaccine helps protect against the 13 types of pneumococcal bacteria that most commonly cause serious infections in children and adults.
- It can also help prevent ear infections and pneumonia caused by those 13 types of pneumococcal bacteria.

# VACCINES AGAINST ROTAVIRUS

# ROTAVIRUS

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- first identified as a cause of diarrhea in 1973 year
- most common cause of severe diarrhea in infants and children
- applies to the majority of children under 5 years
- responsible for 500,000 deaths annually in the world

# ROTAVIRUS

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- infection occurs by ingestion
- short period of incubation(<48 hours)
- most lead to isotonic dehydration
- first infection usually do not give immunity

No typical risk groups. All children in the first years of life are threatened

# Vaccination against pertussis

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Pertussis is an acute bacterial infection of the respiratory tract caused by the bacterium Bordetella pertussis. The disease is characterized by a severe cough lasting two months or even longer.
- Humans are the only reservoir. Healthy carriers probably do not exist, but infected adults usually have only mild symptoms but can shed bacteria for weeks. Following infection (inhaling droplets), susceptible individuals develop symptoms after an incubation period of about 10 days. The typical paroxysmal cough is usually seen in young children. Babies less than six months old do not cough, but they manifest dyspnea and paroxysmal asphyxia and are the most likely to die of the disease unless they receive suitable treatment.
- Affected children are also exposed to complications such as pneumonia, atelectasis, weight loss, hernia, seizures, and encephalopathy (probably due to hypoxia). Antibiotics may reduce the duration of the disease, especially if administered in its early stages.

# Vaccination against pertussis

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- The epidemiological data indicate that in countries with a good implementation of vaccination against whooping cough in infants, it has not been observed to increase the number of cases in this age group

- Cases occur mainly in adolescents and adults, indicating a transient vaccine efficacy

- Clinical observations indicate that the effective protection after vaccination against pertussis remains 5-8 years

# Vaccination against pertussis

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Cases of pertussis in young infants generally relate to children with the unfinished cycle of the primary vaccination; the source of infection is the close environment of the child (parents, siblings)

- The solution to this problem may be the administration of booster doses for older children, adolescents, and adults

# DTaP- FOR INFANTS AND CHILDREN

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

**Children should get five doses of diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine**, one dose at each of the following ages:

- 2 months
- 4 months
- 6 months
- 15 through 18 months
- 4 through 6 years

DTaP vaccine may be given at the same visit as other vaccines.

DTaP is **not** licensed for anyone over the age of six. Children older than six, adolescents, and adults may get a similar vaccine, Tdap.

DTaP replaced an older version of the vaccine, called DTP.

# Tdap- FOR PRE-TEENS, TEENS, AND ADULTS

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- **Tdap** is a tetanus-diphtheria-pertussis vaccine given to adolescents and adults as a one-time shot, or after exposure to tetanus under some circumstances. This is in place of one of the Td shots you would get every ten years.
- Adolescents 11 through 18 years of age (preferably at age 11-12 years) and adults 19 or older – who did not receive Tdap in adolescence – should receive a single dose of Tdap. Tdap is especially important for those in close contact with infants.
- Tdap should also be given to 7 through 10-year-olds who are not fully immunized against pertussis.
- Pregnant women should receive a dose of Tdap during **each** pregnancy, preferably at 27 through 36 weeks to maximize that amount of protective antibodies passed to the baby, but the vaccine can be safely given at any time during pregnancy.

# Vaccination against tuberculosis

BCG is a vaccine against tuberculosis that is prepared from a strain of the attenuated (weakened) live bovine tuberculosis bacillus, *Mycobacterium bovis*, that has lost its virulence in humans by being specially subcultured in a specific culture medium.

# In Poland BCG vaccination is administered to all children within 24 hours after birth.

**Contraindications to BCG vaccination:**

- **Body weight below 2000g (until the achievements of this value)**
- **Children of mothers with HIV - (until the exclusion of infection in a child)**
- **Suspected congenital immune disorders.**

Norway: BCG vaccine was mandatory from 1947 to 1995. It is still available and recommended for high-risk groups.

Sweden: Recommended for children exposed to increased risk; The vaccine is usually given as a single dose from 6 months of age but should be given earlier in case of high risk.

# Vaccination against chickenpox

# Vaccination against chickenpox

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

**Varicella** (chickenpox) is caused by the varicella-zoster virus (VZV), which also causes **shingles**. The virus spreads through the body into the skin causing rashes to appear.

# Varicella- symptoms

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Varicella may begin with cold-like symptoms, followed by a high temperature and a very itchy, blister-like rash. Clusters of spots appear over 3–5 days, mostly on the trunk of the body with some on the limbs. Symptoms vary in severity from person to person. It is possible to have chickenpox and have no symptoms

# Shingles- Symptoms



You can only get shingles if you previously had varicella and the virus is reactivated. Shingles symptoms in older people usually start with pain in the area of the nerve affected — often the chest. A rash of blisters appears in the affected area, usually only on one side of the body. The rash usually lasts around seven days, but the pain can last for longer. Someone with shingles can give the virus to someone who hasn't had chickenpox and is not immune, but not the other way around: a child with varicella cannot give shingles to another person.

# The risk of getting sick after contact with chickenpox

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

-The household relations, closed environments- 80%

- What is the risk of infection by the guardian of the child suffering from shingles?

When the lesions on exposed parts of the body, 20-40%

- Can you resick chickenpox?

You can, but it happens very rarely.

*Gershon A. Varicella-Zoster Virus Infections. Pediatrics in Review, 2008. Vol29 No1 Przedruk PpD 2009 vol13 Nr 4:54-59*

*Mayers M ee. Al.. NelsonTextbook of Pediatrics, 18th ed. 2007:1366-1372*

# Who is at risk of severe chickenpox?

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- youth and adults
- chronic skin diseases (atopic dermatitis)
- chronic lung diseases
- very severe course:
  - newborns
  - pregnant women
  - patients with cancer
  - congenital or acquired immunodeficiency
  - immunosuppressive therapy, including systemic chronic high-dose glucocorticoid therapy

# Perinatal infection

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Mother's illness chickenpox within 5 days before giving birth to two days after birth is perilous for a newborn!
- high risk of varicella spread within the organ- the necessary passive immunoprophylaxis in the newborn (VZIG)

# Indications for vaccination

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- healthy people, the vaccine registered from 9 months of age
- WHO recommends vaccination of children 13-14 months of age and older, adolescents and adults
- people around immunocompromised patients
- chronically ill patients
- healthcare system and education staff who did not have chickenpox and have not been vaccinated
- women in the reproductive period who did not have chickenpox and have not been vaccinated

# Post-exposure Vaccination

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- immunization to three days after exposure - effectiveness> = 90% in the prophylaxis of severe varicella

- immunization 4-5 days after exposure – effectiveness about 70% in the prophylaxis of severe varicella

# Vaccination against Human Papiloma Virus (HPV)

# Vaccine types

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

HPV: 16, 18

HPV: 6, 11, 16, 18

HPV: 6, 11, 16, 18, 31, 33, 45, 52, 58

# Vaccine types

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

HPV: 16, 18

HPV: 6, 11, 16, 18

HPV: 6, 11, 16, 18, 31, 33, 45, 52, 58

(Gardasil 9)

# Immunisation against poliomyelitis

# POLIOMYELITIS

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Polio is caused by polioviruses, classified into types 1, 2, and 3. Humans are the only reservoir of infection: the poliovirus is found in infected individuals' bowels and throats. Transmission occurs via the oral-faecal route or contact with saliva.

- Most infections remain entirely without symptoms, while 10% of cases develop mild symptoms only, such as fever, malaise, nausea, and vomiting. However, after exposure and an incubation period of about one to two weeks, the virus can spread from the digestive tract to the central nervous system, resulting in meningitis and neural damage with paralysis (the latter in less than 1% of cases). No specific therapy is available against the virus.

# Vaccination against Haemophilus influenzae disease

- Haemophilus influenzae is a gram negative coccobacillus
- Haemophilus influenzae  serotype b is the most pathogenic for humans, responsible for respiratory infections, ocular infection, sepsis and meningitis
- Haemophilus influenzae serotype b (Hib) is the most common cause of bacterial meningitis in children aged two months to five years, in those countries where suitable vaccination programmes are not in place
- Children start showing symptoms of meningitis after a probable incubation period of about 2–4 days and clinical manifestations tend to evolve rapidly. Even with adequate and prompt antibiotic treatment, mortality can reach up to 10% of cases

# Immunisation against tetanus

# TETANUS



- Tetanus is a fatal disease that is present worldwide. It is a consequence of a toxin produced by the bacterium *Clostridium tetani*
- Most cases of human disease occur as a result of a wound being contaminated by earth or dust
- After an incubation period averaging two weeks (sometimes longer), the toxin produced by the bacteria in the wound is absorbed and starts making its effects
- Non-specific early signs (fever, irritability) are followed by the appearance of localized muscular contractions (lockjaw)
- Finally, generalized spasms may occur, often leading to death from heart and lung failure
- The overall death rate is close to 50%, depending on the clinical presentation, patient's age, and medical support

# Contraindications and Precautions

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- There are many reasons for not giving vaccines.
- Sometimes, vaccines cannot be given or need to be delayed due to contraindications or precautions.
- Other times, people have unfounded concerns that lead to hesitation in getting vaccinated when there is no increased risk for vaccination.
- It is critical for vaccine providers to distinguish among these different reasons.

# Contraindications and Precautions

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

A **contraindication** is when a drug, such as a vaccine, should **not** be used because the risk outweighs any potential therapeutic benefit.

A **precaution** is a condition that may increase the risk of an adverse reaction following immunization or compromise the vaccine's ability to produce immunity. In general, vaccines are deferred when a precaution is present. However, there may be circumstances when the benefits of giving the vaccine outweigh the potential harm or when reduced vaccine immunogenicity may still significantly benefit a susceptible, immunocompromised host.

# Anaphylactic reaction to a vaccine or a component of a vaccine

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

A vaccine is contraindicated in a person with a history of anaphylaxis after a previous administration of the same vaccine.

# Immunocompromised persons

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Immunocompromised people should not receive live vaccines because of the disease risk caused by the vaccine strains.

# Suspicious family or medical history for immunodeficiency disorders

UNIWERSYTET MIKOŁAJA KOPERNIKA W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

People who have a suspicious history of immunodeficiency disorders (e.g., known or suspected family history of a congenital immunodeficiency disorder or HIV infection) should not be immunized with a live vaccine.

# Immunosuppressive therapy

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Vaccination status should be reviewed before commencing immunosuppressive therapy.
- If vaccines cannot be given before initiation of therapy, it is advisable to delay vaccines until after immunosuppressive treatment has stopped.
- Inactivated vaccines should be delayed 3 months (to ensure immunogenicity), and live vaccines should be delayed 1-3 months (to reduce the risk of disease caused by the vaccine strain).
- The interval between discontinuation of immunosuppressive drugs and vaccine administration may vary with the intensity of the immunosuppressive therapy, underlying disease, and other factors.

# Common conditions and concerns

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

People with minor or moderate acute illness may receive vaccines. There is no increase in risk of adverse events following immunization and no interference with response to vaccine.

# Allergies

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

A history of allergies is one of the most common concerns about vaccines. There are many types of allergic reactions, and it is essential to differentiate between them when considering the implications of immunization.

Anaphylactic egg allergy is rare. People with egg allergy may be immunized with MMR or MMRV vaccines routinely. Egg-allergic individuals may be vaccinated against influenza.

# Breastfeeding



Following routine immunization of either a mother or her infant during breastfeeding, there is no reduction in maternal or infant response to vaccines and no increase in the risk of adverse events for either mother or infant. There is some evidence that breastfeeding may benefit infants after vaccination and is associated with less fever and pain.

# Concern about exposure to too many antigens

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

Parents are often concerned about exposing their young child to too many antigens when multiple vaccines are recommended at one time. It is helpful to identify that the human immune system has an enormous capacity to respond to antigens; infants can respond to about 10,000 antigens at any one time – and may do so when crawling on the floor.

# Concern about multiple injections

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Routine administration of all age-appropriate doses of vaccines simultaneously is recommended for children without contraindications. There are no contraindications to giving multiple injections at the same visit, and all opportunities to immunize should be utilized.
- Concomitant administration of most routine vaccines at the same visit does not result in decreased antibody responses or increased rates of adverse reaction.

UNIWERSYTET
MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Lekarski
Collegium Medicum w Bydgoszczy

- Modern vaccines are incredibly safe and effective
- No vaccine is completely free of side effects
- Adverse events after immunization have been reported with all vaccines
- They range from frequent, minor, local reactions to sporadic, severe, systemic illness