



# Immune System and Vaccination

*“Immunization is a proven tool for controlling and eliminating life-threatening infectious diseases and is estimated to avert between 2 and 3 million deaths each year. It is one of the most cost-effective health investments, with proven strategies that make it accessible to even the most hard-to-reach and vulnerable populations. It has clearly defined target groups; it can be delivered effectively through outreach activities; and vaccination does not require any major lifestyle change.”*

WHO, 2019



# Immune System



It is important to understand the basics of the immune system in order to:

- understand how vaccines work
- understand the vaccination recommendations

Immunity = the ability of the human body to protect itself from infectious diseases

- discrimination of indigenous and foreign material in the body > ability to tolerate indigenous - and eliminate foreign material

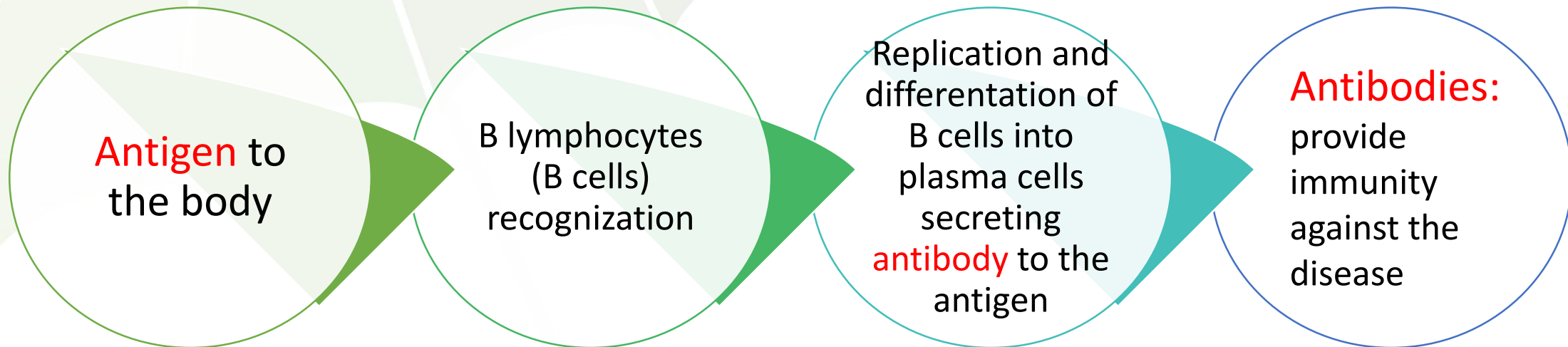


- Non-specific immunity (from birth):  
physical barriers (e.g., skin and mucous membranes) and chemical barriers (e.g., gastric acid, digestive enzymes and acids of the skin)
- Acquired immunity:  
against a specific organism or a group of organisms

# Active Immunity



- Immunity produced by a person's own immune system
- Usually lasts a long time; even for a whole lifetime
- Obtained by contracting a disease or by vaccination
- Type A: Antibody mediated immunity: produced mainly by B lymphocytes (=B cells) in interaction with T cells

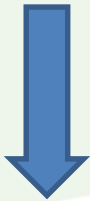


# Active Immunity (continued)



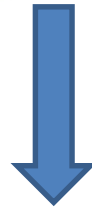
- Type B: Cell-mediated immunity > T lymphocytes (=T cells)

T helper  
cells



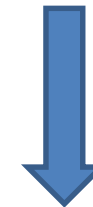
Stimulate the  
immune response  
of other cells  
(e.g., B cells)

T suppressor  
cells



Inhibit and control  
the level of  
immune response

Cytotoxic  
T cells



Recognize and destroy  
infected cells and  
activate phagocytes



# Passive Immunity



- Another individual or an animal has produced **antibodies** against some microbe
- These antibodies have been transferred to another human being
  - By placenta (during pregnancy)
  - By breastfeeding a baby
  - By injection (immunoglobulin)
  - By transfusion of blood or blood products
- Immunity is effective but temporary: usually not lifelong



# Vaccines produce active immunity



- Vaccines can be produced from:
  - Live attenuated microbes
  - Inactivated = killed microbes
  - Inactivated microbial toxins
  - Surface proteins of microbes
  - Different kinds of microbial components

Vaccination > antigens to the body > active immunity system activation > antibodies against the microbe > protection against the disease



# How do vaccines work?



Vaccination >

Antigens to the body >

Active immune system activation >



Antibodies against the microbe >

Immunological memory >



Rapid response to the natural infection >

Protection against the disease





# Inactivated Vaccines



- Whole killed viruses or bacteria OR
- Secreted products or microbial components (e.g., an element of the cell wall)
- Cannot cause the disease
- Multiple doses of the vaccine are needed to get protection
- May require periodic booster doses
- Most vaccines are inactivated



# Live Attenuated Vaccines



- Viruses or bacteria which are attenuated or weakened in a laboratory
- Must replicate in the vaccinated person's body for days or weeks > immune response (identical with natural infection)
- Usually does not cause the disease but it is possible (milder than the natural disease)
- Usually produce immunity with one or two doses - no booster doses needed
- Severe reactions are possible in persons with immunodeficiency
- Fragile vaccines; careful storage and handling are required
- For example: MMR, Varicella, Rota virus, BCG vaccines



# Active immunity by contracting the disease or by vaccination?



Suffering from infectious disease (possibly severe)

Immune system reacts

Recovery OR COMPLICATION (possibly severe, even permanent damage or death)

Protection against the disease

Vaccination

Immune system reacts

Possible side effects of the vaccine (usually mild and temporary)

Protection against the disease

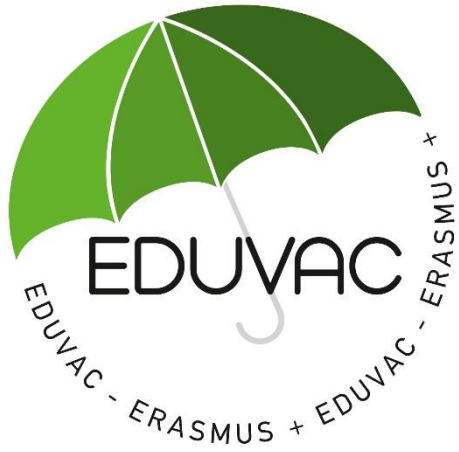


# References



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