Adaptive or Specific Immunity

The **adaptive immune system**, also known as the **acquired immunity**, acquired immunity creates immunological memory after an initial response to a specific pathogen, leading to an enhanced response to subsequent encounters with that same pathogen. This process of acquired immunity is the basis of vaccination.

The adaptive immune or specific immune response consists of antibody responses and cell-mediated responses, which are carried out by different lymphocyte cells, B cells and T cells, respectively. B Cells are the major cells involved in the creation of antibodies that circulate in blood plasma and lymph, where they bind specifically to the foreign antigens.

Types of Adaptive or Specific Immunity

Immunity is the ability to resist infection by an invading pathogen. The body quickly launches an immune response and prevents the symptoms of disease occurring. This can happen in two ways – naturally or artificially. Natural immunity occurs without human intervention and artificial immunity occurs when antigens or antibodies are given to a person by artificial means, eg by injection. Passive immunity is when a person is given antibodies produced by someone else. This could happen naturally when a mother passes her own antibodies to her baby either through her placenta or her breast milk. Another method of gaining passive immunity is artificially, for example when a person is given an injection of antibodies if they suspect that they have been exposed to a disease such as tetanus or diphtheria. In this situation, immunity is established immediately.

This form of immunity is short lived as no memory cells are produced. Longer-term immunity is gained via active immunity. Examples of this

involve the body being stimulated to produce antibodies via a specific immune response. This occurs either by a person contracting a disease which is referred to as natural active immunity or via an injection of weakened (attenuated) or dead antigens. In this case an immune response is activated resulting in the production of antibodies and memory cells. This latter form of immunity is called artificial active immunity. The principle of immunization is based on this.

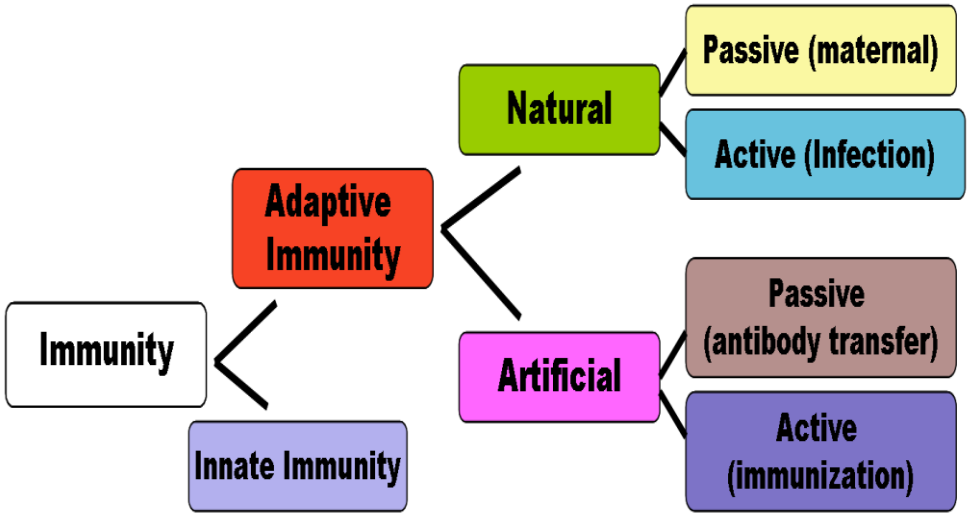
Types of natural and artificial immunity

-natural, active immunity – after having been infected by the pathogen and your immune system responds; a person is infected by the disease once and then the production of antibodies grants future immunity

-artificial, active immunity – e.g. after having been given a vaccination of a small, harmless version of a disease so that the immune system is triggered to develop appropriate antibodies, giving immunity

-natural, passive immunity – receiving antibodies not from your own immune system, but not artificially, so for example from breast milk or across the placenta during pregnancy

- artificial, passive immunity – receiving the antibodies again not from your own immune system, e.g. from an injection of the direct antibodies, rather than the disease, so the immune system does not need to respond.



Vaccine

A **vaccine** is a biological preparation that improves immunity to a particular disease. A vaccine typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins or one of its surface proteins. The agent stimulates the body's immune system to recognize the agent as foreign, destroy it, and keep a record of it, so that the immune system can more easily recognize and destroy any of these microorganisms that it later encounters.

Vaccines can be prophylactic (example: to prevent the effects of a future infection by any natural or "wild" pathogen), or therapeutic (e.g., vaccines against cancer are also being investigated).

Types of vaccines

1-Inactivated

Some vaccines contain inactivated, but previously virulent, micro-organisms

that have been destroyed with chemicals, heat, radioactivity, or antibiotics. Examples are influenza, cholera, polio, hepatitis A.

2-Attenuated

Some vaccines contain live, attenuated microorganisms. Many of these are active viruses that have been cultivated under conditions that disable their virulent properties

Examples include the viral diseases yellow fever, measles, rubella, and mumps, and the bacterial disease typhoid.

3-Toxoid

Toxoid vaccines are made from inactivated toxic compounds that cause

illness. Examples of toxoid-based vaccines include tetanus and diphtheria.Toxoid vaccines are known for their efficacy.

4-Subunit

Protein subunit – rather than introducing an inactivated or attenuated microorganism to an immune system (which would constitute a "whole-agent" vaccine), a fragment of it can create an immune response. Examples include the subunit vaccine against Hepatitis B virus .

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5-Conjugate

Conjugate – certain bacteria have polysaccharide outer coats that are poorly immunogenic. By linking these outer coats to proteins (e.g., toxins),

the immune system can be led to recognize the polysaccharide as if it were a protein antigen. This approach is used in the *Haemophilus influenzae* type B vaccine.

6- mRNA vaccines

mRNA vaccines have strands of genetic material called mRNA inside a special coating.

Examples of Vaccines

I. Bacterial vaccines

a. Live (BCG vaccine for tuberculosis)

b. Killed (cholera vaccine)

c. Subunit (typhoid Vi antigen)

d. Bacterial products (tetanus toxoid)

2. Viral vaccines

a. Live

– Oral polio vaccine-Sabin

– 17D vaccine for yellow fever

– MMR vaccine for measles, mumps, rubella.

b. Killed

– Injectable polio vaccine-Salk

– Neural and non-neural vaccines for rabies

– Hepatitis B vaccine

c. Subunit: Hepatitis B vaccine