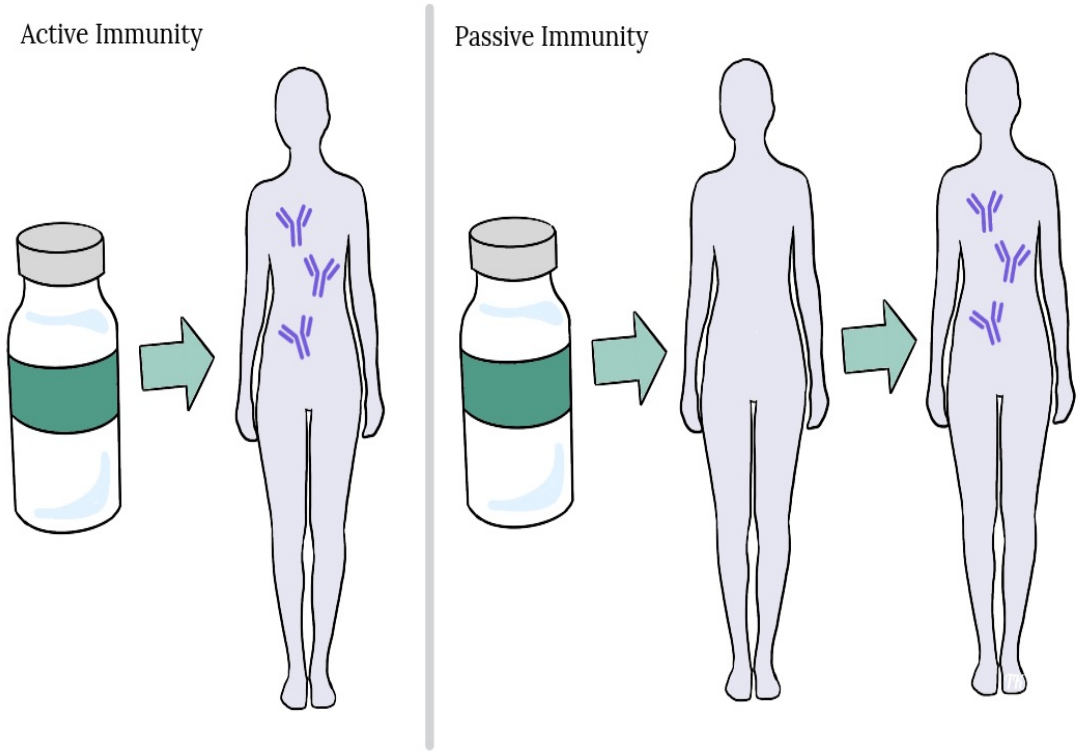
Immunity

Immunity refers to the body's ability to prevent the invasion of pathogens. Pathogens are foreign disease-causing substances, such as bacteria and viruses, and people are exposed to them every day. Antigens are attached to the surface of pathogens and stimulate an immune response in the body. An immune response is the body's defense system to fight against antigens and protect the body.

There are several types of immunity, including innate immunity, passive immunity, and acquired/active immunity.This image is a visual showing active immunity as a process of exposing the body to an antigen to produce an adaptive immune response, while passive immunity "borrows" antibodies from another person.



1. **Innate immunity**

   is general protection that a person is born with, including physical barriers (skin, body hair), defense mechanisms (saliva, gastric acid), and general immune responses (inflammation). This type of immunity is considered non-specific. Although the immune system does not know exactly what kind of antigen is invading the body, it can respond quickly to defend against any pathogen.

2. **Passive immunity**

   is the body's capacity to resist pathogens by "borrowing" antibodies. For example, antibodies can be transferred to a baby from a mother's breast milk, or through blood products containing antibodies such as immunoglobulin that can be transfused from one person to another. The most common form of passive immunity is that which an infant receives from its mother. Antibodies are transported across the placenta during the last one to two months of pregnancy. As a result, a full-term infant will have the same antibodies as its mother. These antibodies will protect the infant from certain diseases for up to a year, and act to defend against specific antigens. Although beneficial, passive immunity is temporary until the antibodies are gone (wane), since the body has not produced the antibodies.

3. **Acquired (adaptive) immunity**

   is a type of immunity that develops from immunological memory. The body is exposed to a specific antigen (which is attached to a pathogen) and develops antibodies to that specific antigen. The next time said antigen invades, the body has a memory of the specific antigen and

already has antibodies to fight it off. Acquired immunity can occur from exposure to an infection, wherein a person gets a disease and develops immunity as a result. Acquired immunity also occurs from vaccination wherein the vaccine mimics a particular disease, causing an immune response in the vaccinated individual without getting them ill.

How does the immune system work?

The immune system defends the body against substances it sees as harmful or foreign. These substances are called antigens.

Antigen is any substance that can spark an immune response,they may be germs such as bacteria,fungus and viruses or they might be chemicals or toxins or foreign body, and they could be cells that are damaged from things like cancer or sunburn, or our own cells that is faulty or dead.

When your immune system recognizes an antigen, it attacks it. This is called an immune response. Part of this response is to make antibodies. Antibodies are proteins that work to attack, weaken, and destroy antigens. The body also makes other cells to fight the antigen. Afterwards, the immune system remembers the antigen. If it sees the antigen again, it can recognize it. It will quickly send out the right antibodies, so in most cases, you don't get sick. This protection against a certain disease is called immunity.

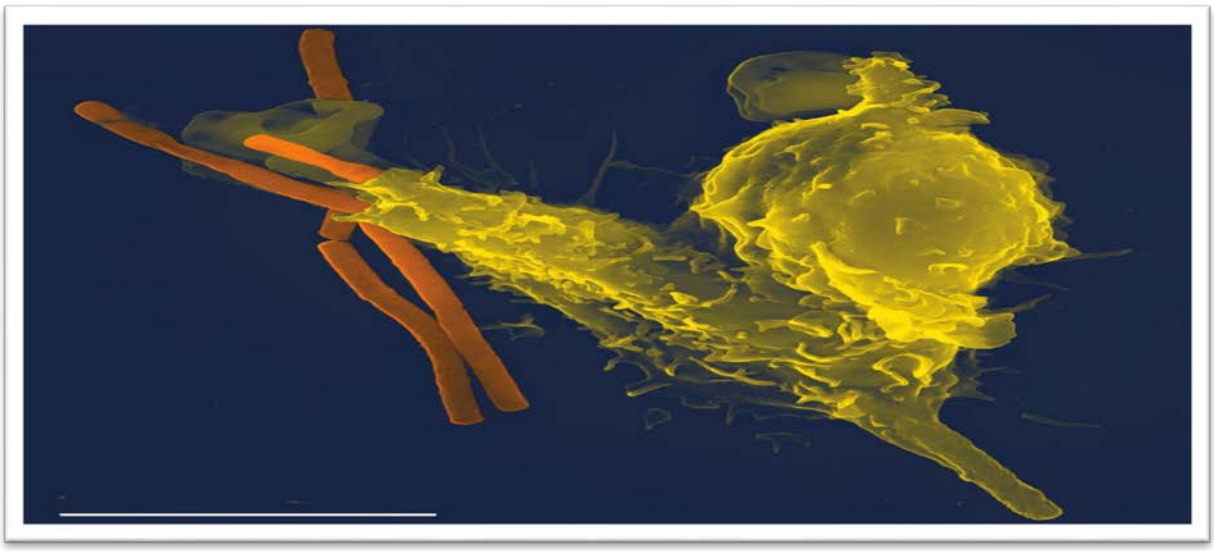
The parts of the immune system

The immune system has many different parts, including:

- Skin, which can help prevent germs from getting into the body
- Mucous membranes, which are the moist, inner linings of some organs and body cavities. They make mucus and other substances which can trap and fight germs.
- White blood cells, which fight germs
- Organs and tissues of the lymph system, such as the thymus, spleen, tonsils, lymph nodes, lymph vessels, and bone marrow. They produce, store, and carry white blood cells.

White blood cells

White blood cells are also called leukocytes. They circulate in the body in blood vessels and the lymphatic vessels that parallel the veins and arteries. White blood cells are on constant patrol and looking for pathogens. When they find a target, they begin to multiply and send signals out to other cell types to do the same.



White blood cell (yellow), attacking anthrax bacteria (orange).

Our white blood cells are stored in different places in the body, which are referred to as lymphoid organs. These include the following:

- **Thymus** — a gland between the lungs and just below the neck.
- **Spleen** — an organ that filters the blood. It sits in the upper left of the abdomen.
- **Bone marrow** — found in the center of the bones, it also produces red blood cells.
- **Lymph nodes** —small glands positioned throughout the body, linked by lymphatic vessels.

There are two main types of leukocyte:

1. Phagocytes

These cells surround and absorb pathogens and break them down, effectively eating them. There are several types, including:

- **Neutrophils** — these are the most common type of phagocyte and tend to attack bacteria.
- **Monocytes** — these are the largest type and have several roles.
- **Macrophages** — these patrol for pathogens and also remove dead and dying cells.
- **Mast cells** — they have many jobs, including helping to heal wounds and defend against pathogens.

2. Lymphocytes

Lymphocytes help the body to remember previous invaders and recognize them if they come back to attack again. Lymphocytes begin their life in bone marrow. Some stay in the marrow and develop into B lymphocytes (B cells), others head to the thymus and become T lymphocytes (T cells). These two cell types have different roles:

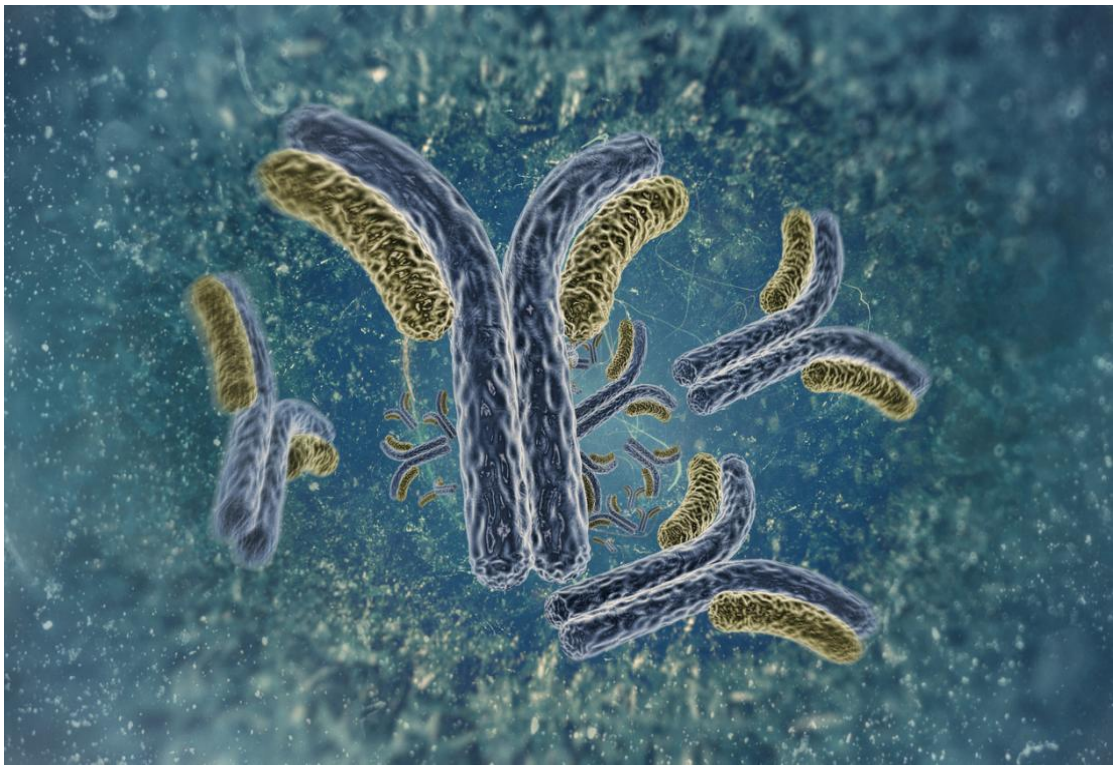
- **B lymphocytes** — they produce antibodies and help alert the T lymphocytes.
- **T lymphocytes** — they destroy compromised cells in the body and help alert other leukocytes.

The role of B lymphocytes

Once B lymphocytes spot the antigen, they begin to secrete antibodies. Antibodies are special proteins that lock on to specific antigens. Each B cell makes one specific antibody. For instance, one might make an antibody against the bacteria that cause pneumonia, and another might recognize the common cold virus. Antibodies are part of a large family of chemicals called immunoglobulins, which play many roles in the immune response:

- **Immunoglobulin G (IgG)** — marks microbes so other cells can recognize and deal with them.
- **IgM** — is expert at killing bacteria.
- **IgA** — congregates in fluids, such as tears and saliva, where it protects gateways into the body.
- **IgE** — protects against parasites and is also to blame for allergies.

- **IgD** — stays bound to B lymphocytes, helping them to start the immune response.



B lymphocytes secrete antibodies that lock onto antigens.

The role of T lymphocytes

There are distinct types of T lymphocytes:

Helper T cells (Th cells) — they coordinate the immune response. Some communicate with other cells, and some stimulate B cells to produce more antibodies. Others attract more T cells or cell-eating phagocytes.

Killer T cells (cytotoxic T lymphocytes) — as the name suggests, these T cells attack other cells. They are particularly useful for fighting viruses. They work by recognizing small parts of the virus on the outside of infected cells and destroy the infected cells.

Immune system disorders: Because the immune system is so complex, there are many potential ways in which it can go wrong. Types of immune disorder fall into three categories:

Immunodeficiencies

These arise when one or more parts of the immune system do not function. Immunodeficiencies can be caused in a number of ways, including age, obesity, and alcoholism. In developing countries, malnutrition is a common cause. AIDS (Acquired ImmunoDeficiency Syndrom) is an example of an acquired immunodeficiency caused by HIV (Human Immunodeficiency Virus). In some cases, immunodeficiencies can be inherited, for instance, in chronic granulomatous disease where phagocytes do not function properly.

Autoimmunity

In autoimmune conditions, the immune system mistakenly targets healthy cells, rather than foreign pathogens or faulty cells, they cannot distinguish self from non-self. Autoimmune diseases include celiac disease, type 1 diabetes, rheumatoid arthritis.

Hypersensitivity

With hypersensitivity, the immune system overracts in a way that damages healthy tissue. An example is anaphylactic shock where the body responds to an allergen so strongly that it can be life-threatening.