

Adaptive Immunity

by Sophia

WHAT'S COVERED

In this lesson, you will learn to identify the characteristics of the body's third line of defense against pathogens. Specifically, this lesson will cover:

1. Adaptive Immunity

Adaptive immunity is the body's third line of defense against pathogens. The immune system produces millions of lymphocytes, each with a random, unique antibody. Lymphocytes that produce antibodies that would attack our own body are weeded out (if they aren't, autoimmune diseases such as multiple sclerosis will result). The remaining lymphocytes then circulate the body.

If a pathogen invades our body, one of the random lymphocytes will have an antibody that recognizes it; because the lymphocytes that recognize our own body have been destroyed, any lymphocyte that binds an antigen must be binding the antigen of an invading pathogen. The lucky lymphocyte will then divide to create memory cells, so our bodies will always produce the antibody we know binds to a pathogen. If we ever encounter that particular pathogen again, we have the means to recognize and destroy it before it can replicate within our bodies and do damage.

TERM TO KNOW

Adaptive Immunity

Also known as specific immunity, adaptive immunity is carried out by T & B lymphocytes and reacts to specific antigens of cells; adaptive immunity also produces memory cells to target the same pathogen if we are ever exposed to it again.

2. Adaptive Immunity Cells

Adaptive immunity has three types of cells involved:

- T cells: Cells that kill abnormal cells and help to activate B cells
- B cells: Cells that help to make antibodies
- Phagocytes, which fight specific pathogens

T cells and B cells are both lymphocytes, or types of white blood cell, which make receptors for one specific

type of antigen and attack anything that has that antigen. **Antigens** are unique chemical markers that allow the immune system to distinguish between our own cells and invading pathogens. Antibodies and antigens fit together like a lock and a key. Antibodies are a folded up protein with a specific shape, and antigens have this specific shape as well.

THINK ABOUT IT

Question: How does your body know not to attack your own cells?

Answer: Within your cells, or on your cells, you have something called**MHC** markers. Our cells constantly recycle their macromolecules (like changing the oil in our cars), and bits of the recycled material is brought to the plasma membrane and displayed on the cell's surface via MHC markers. If the MHC displays normal cell material, the immune system knows the cell is healthy. But if a cell is infected with a virus, the MHC will display bits of viral protein on the cell's surface, which are antigens that our immune system will recognize as foreign. The infected cell will be marked as sick and targeted for destruction before it produces more pathogens and spreads the disease.

Adaptive immunity takes about a week to develop, but it produces**memory cells**. If a person comes in contact with an illness or a disease or a pathogen that they've already had in the past, memory cells will be able to fight that off quicker if they are encountered again—you might not even notice any symptoms. These memory cells allow the body to fight off this pathogen quicker the second time around. It basically provides us with immunity.

TERMS TO KNOW

T Cells

Also known as T lymphocytes, T cells carry out a version of specific immunity called cell-mediated immunity or cellular immunity; there are two kinds of T lymphocytes: Helper T cells (which recruit other cells in the immune system) and cytotoxic T cells (which kill pathogenic cells).

B Cells

Also known as B lymphocytes, B cells carry out a version of specific immunity called humoral immunity. During humoral immunity, B cells produce and secrete antibodies into our body tissue cavities.

Antibodies

Specific protein markers that are created by the immune system for binding and reacting to specific antigens; antibodies are created by B cells during humoral immunity.

Antigens

A unique chemical marker found on the surface of cells that have the potential to stimulate an immune response; antigens are basically the identity marker of cells for the immune system to see.

MHC

Also known as major histocompatibility complex, MHCs are cellular markers on the plasma membrane that play an important role in mediating adaptive immunity.

Memory Cells

Memory cells are genetically programmed cells that have gone through an initial exposure to a pathogen/antigen that can coordinate a much more specific and rapid response if we are ever exposed to that same pathogen/antigen.

3. Types of Adaptive Immunity

There are two types of adaptive immunity:

- *Antibody-mediated immunity.* Also known as humoral immunity, an antibody is basically an antigen receptor. Antibodies will flag a certain antigen to be picked up and disposed of. This type is associated mainly with B cells, which mature in the bone marrow.
- *Cell-mediated immunity*. Cell-mediated immunity involves T lymphocytes. Like B cells, T cells are made in bone marrow, but T cells mature in the thymus, an organ at the base of your neck. They attack and destroy antigens found on specific cells.



🖯 SUMMARY

Adaptive immunity is carried out by the T and B lymphocytes (a type of white blood cell). They will flag and attack only specific pathogens that enter the body. Once the B cells have developed an antibody against a pathogen, adaptive immunity will create memory cells to protect the body against future attacks. There are two **types of adaptive immunity**. Antibody-mediated immunity involves flagging an antigen to be disposed of, while cell-mediated immunity involves lymphocytes attacking the antigen.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND

TERMS TO KNOW

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Antibodies

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A unique chemical marker found on the surface of cells that have the potential to stimulate an immune response; antigens are basically the identity marker of cells for the immune system to see.

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