

Immune System Disorders and HIV/AIDS

by Sophia



WHAT'S COVERED

In this lesson, you will learn to identify several immune system disorders. Specifically, this lesson will cover:

1. Allergies

Allergies are when a generally harmless substance enters the body and causes this immune system to attack. Dust, pollen, food, certain medications, pet dander, et cetera can all be allergens. Allergens cause a person's mucous membranes to become inflamed.

IN CONTEXT

Let's say that you are allergic to pollen and you are outside on a day and inhale some pollen. As you inhale that pollen, it will enter your system and attach or bind to B cells in your body. This causes effector B cells to make and secrete IgE antibodies to that allergen. Those antibodies are going to attach to mast cells, a type of white blood cell found in your tissues, which stimulates the release of histamines.

The release of histamine granules is what causes inflammation, including inflammation of your mucous membranes. This is what makes you feel so awful when you have allergies.

Treatments for allergies can include:

- Antihistamines: Drugs that you can buy that provides short-term allergy relief by blocking the effects of histamines.
- Desensitization therapy: A way to treat allergies that stimulates the body to produce IgG antibodies instead of IgE.

Anaphylactic shock is a type of whole-body allergic reaction, which is very serious and can cause death. A person who goes into anaphylactic shock would need to be injected with epinephrine, which is a drug that will help reverse the effects of the shock.



TERMS TO KNOW

Allergy

A hypersensitivity (overreaction) to environmental substances called allergens; an allergic response is carried out by the release of histamine and is basically an inflammatory response.

Anaphylactic Shock

Shock is a general term to describe a severe drop in blood pressure; anaphylactic shock is caused by an extreme allergic reaction that causes blood volume and blood pressure to drop as a result of excessive histamine release and inflammation.

2. Autoimmune Disorders

Autoimmune disorders, or **autoimmunity**, are when the immune system attacks normal healthy body cells. The following are examples of autoimmune disorders:

- **Rheumatoid arthritis:** An autoimmune disorder where joint tissue is attacked. This causes the joints to become inflamed, and it can be really painful.
- **Type I diabetes:** An autoimmune disorder in which insulin-producing cells of the pancreas are attacked by the patient's own immune system. The pancreas can no longer produce insulin, and people who have Type I diabetes generally have to use injectable insulin in order to control their blood glucose levels.
- **Lupus:** An autoimmune disorder that's characterized by a butterfly rash on the face. With lupus, antibodies are produced to a person's own DNA. Lupus has a wide range of effects on the body.



TERMS TO KNOW

Autoimmunity

When the immune system recognizes a self-antigen as being foreign and attacks it; when the immune system attacks our own tissues/organs.

Rheumatoid Arthritis

An autoimmune disease where the immune system produces autoantibodies against the connective tissue capsules of synovial joints; this causes severe inflammation and disfigurement of synovial joints, especially noticeable in the hands and feet.

Type I Diabetes

A metabolic disease known as diabetes mellitus, type I diabetes is an autoimmune disease that causes the destruction of pancreatic β cells; β cells are responsible for producing and secreting insulin, so when a person loses these cells they have a difficult time metabolizing glucose.

Lupus

Known as systemic lupus erythematosus, lupus is a systemic autoimmune disease that can affect any organ system; lupus can be very difficult to diagnose because its signs and symptoms may mimic other diseases.

3. Immunodeficiency

Immunodeficiency is when a person's own immune system is weak or almost nonexistent.

AIDS is an example of immunodeficiency. It stands for Acquired Immune Deficiency Syndrome. AIDS is a disease caused by the **HIV** virus, and it leads to a person's immune system not working, making them susceptible to contracting many other types of diseases.

HIV is a **retrovirus**; its genetic information is in the form of RNA instead of DNA. This means that the virus will insert its genes into our own white blood cells' DNA; when the cell replicates, so does all the information necessary to create a viral infection.



TERMS TO KNOW

Immunodeficiency

A general term used to describe a person that has a weakened/compromised immune system; immunodeficiencies cause a person to be susceptible to opportunistic infections, which are infections you wouldn't usually get with a healthy immune system.

AIDS

Acquired immunodeficiency syndrome, AIDS is caused by the HIV virus; a person with AIDS has a very low helper T cell count that causes the patient to lose their ability to coordinate their immune response making them immunodeficient and susceptible to opportunistic infections.

HIV

A virus that causes the disease known as AIDS.

Retrovirus

A virus whose genetic information is in the form of RNA rather than DNA.

3a. Replication

When HIV infects helper T cells, macrophages, and dendritic cells, it injects its RNA into these cells, along with a viral enzyme called reverse transcriptase. Reverse transcriptase converts the viral RNA into DNA, which then gets mixed in with the cell's DNA.

After a prolonged incubation (in which the infected person has no symptoms), the virus will erupt from the infected cells and destroy them. Destroyed helper T cells, macrophages, and dendritic cells means that there are very few cells able to do the immune system's job. This leaves the patient vulnerable to all sorts of pathogens a typical immune system can fight quite easily. Ultimately, it is this inability to fight the infection that makes AIDS so deadly.



BIG IDEA

The HIV virus is going to enter into the lymphocyte, and the RNA of the virus will mix with the DNA of the host cell. Then what's going to happen is that DNA is going to be transcribed. Once that DNA is transcribed, it's going to produce new virus particles. The virus particles will be assembled from viral RNA and proteins. The virus is infecting healthy cells using the cell's DNA in order to produce more viruses.

3b. Transmission

HIV is transmitted through bodily fluids, especially blood and semen; thus, it is often spread through sexual intercourse or needle-sharing. It can also be passed from mother to child through childbirth or breastfeeding.

Currently, Africa is the continent with the highest population of infected people.

3c. Treatment

HIV and AIDS are hard to treat for a few reasons. It mutates rapidly and develops resistance to drugs very easily, and it injects its own RNA into the host cells' DNA. It is not possible to remove the HIV genes from someone else's DNA.

There is no cure for HIV and AIDS, but there is a treatment that can slow the process down. It includes a cocktail of drugs which involve:

- A protease inhibitor, which blocks the action of HIV protease. HIV protease is an enzyme that is required to make new viruses.
- Two anti-HIV drugs.



SUMMARY

There are many immune system disorders and diseases that can impact your immune system.

Allergies are when generally harmless substances enter the body and cause an immune system attack. **Autoimmune disorders** are when a person's own immune system attacks their own healthy body cells, as is the case with lupus. **Immunodeficiency** is a general term to describe a person that has a weakened or compromised immune system. AIDS is an example of this kind of disorder.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND



TERMS TO KNOW

AIDS

Acquired immunodeficiency syndrome, AIDS is caused by the HIV virus. A person with AIDS has a very low helper T-cell count. This makes it difficult for the immune system to coordinate responses against infections.

Allergy

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