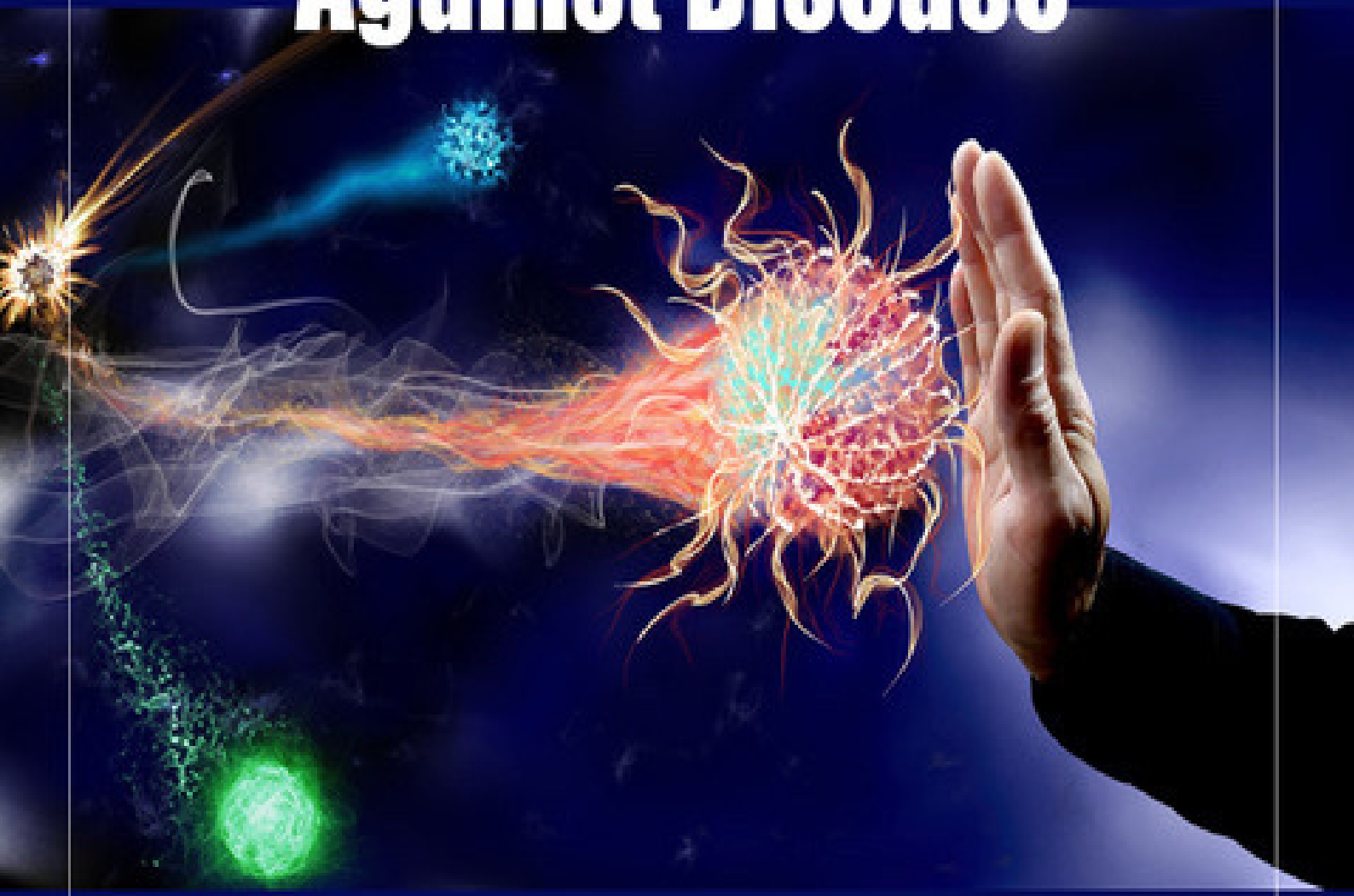
How Your Immune System Protects Your Body Against Disease



By Tim Newman
of *Medical News Today*

Reviewed by
Daniel Murrell, M.D.

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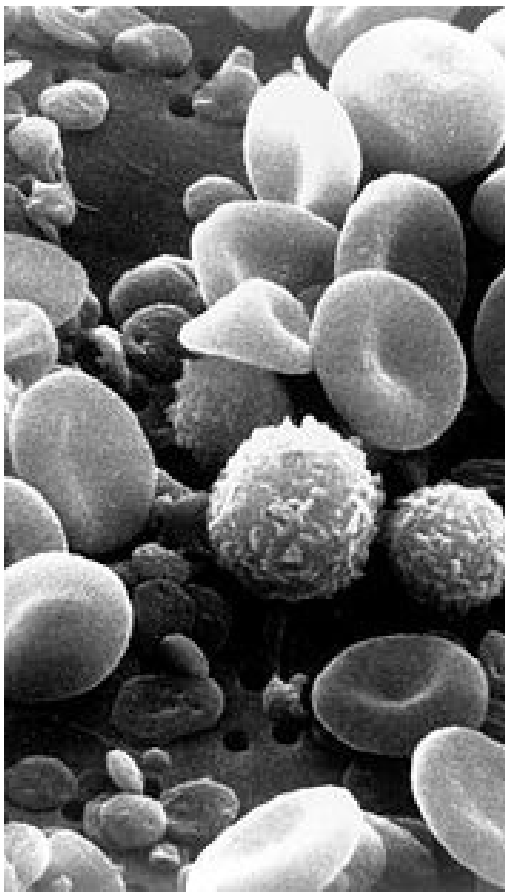
OUR IMMUNE SYSTEM

Our immune system is essential for our survival. Without it, our bodies would be open to attack from bacteria, viruses, parasites, and more. This marvelous and complex system keeps us healthy as we drift through a sea of pathogens. This vast network of cells and tissues is constantly on the lookout for invaders, and once an enemy is spotted, it mounts a complex attack.

The immune system is spread throughout our body and includes cells, organs, proteins, and tissues. It can distinguish our own tissue from foreign tissue—self from non-self. Dead and faulty cells are recognized and cleared away. Encountering a pathogen such as a bacterium, virus, or parasite, it mounts what's called an immune response. But before we go into detail explaining how all this works let's introduce some of the main characters.

WHITE BLOOD CELLS



These cells (also called leukocytes) circulate in your blood vessels and in the lymphatic vessels that parallel veins and arteries. They are on constant patrol looking for pathogens.

When they find a target, they multiply and send signals to other cell types to do the same. White blood cells are stored throughout your body in lymphoid organs such as:

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
Small glands positioned throughout the body, linked by lymphatic vessels.

1. PHAGOCYTES

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

NEUTROPHILS
These are the most common type of phagocyte and tend to attack bacteria.

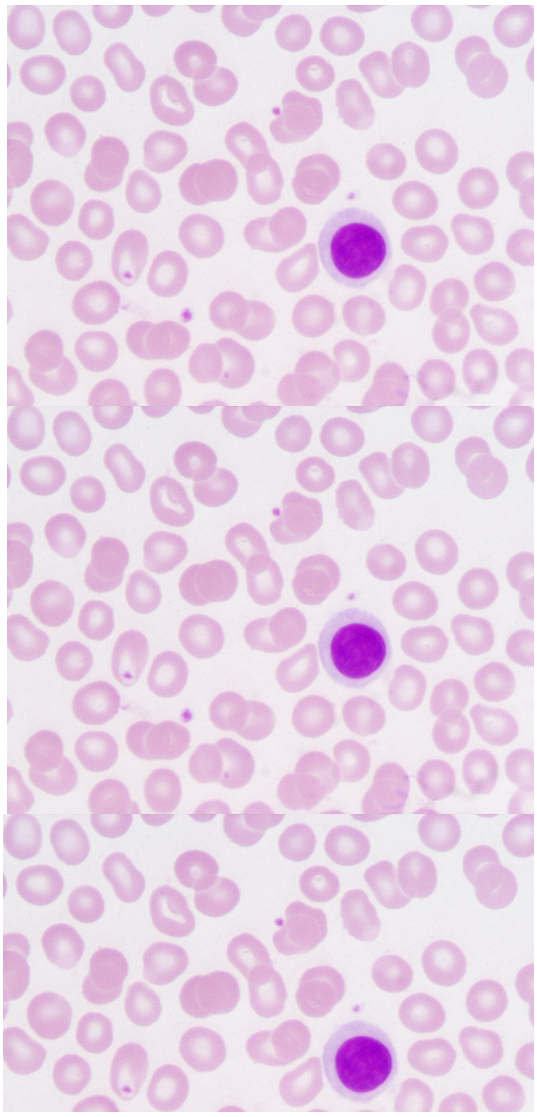
MONOCYTES
These are the largest type and have several roles.

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

These cells help the body to remember previous invaders and recognize them if they come back to attack. Lymphocytes begin their life in the bone marrow. Some stay in the marrow developing into B Lymphocytes (B cells), while others head to the thymus to become T Lymphocytes (T cells).



B LYMPHOCYTES
Produce antibodies and help alert the T lymphocytes.

T LYMPHOCYTES
Destroy compromised cells in the body and help alert other leukocytes.

HOW AN IMMUNE RESPONSE WORKS

B LYMPHOCYTES SECRETE ANTIBODIES (pictured above) THAT LOCK ONTO ANTIGENS.

The immune system needs to be able to tell self from non-self. It does this by detecting proteins found on the surface of all cells. It learns to ignore its own or self-proteins at an early stage.

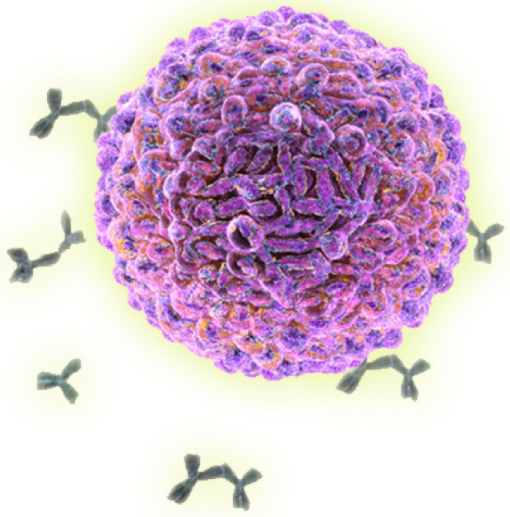
An antigen is any substance that sparks an immune response.

In many cases, an antigen is a bacterium, fungus, virus, toxin, or foreign body. But it can also be one of our own cells that is faulty or dead. Initially, a range of cell types works together to recognize the antigen as an invader.

Antibodies lock onto the antigen, but they don't kill it, they only mark it for death. The actual killing is the job of other cells such as Phagocytes.

THE ROLE OF B LYMPHOCYTES

Once B Lymphocytes spot the antigen, they secrete antibodies (antigen is short for “antibody generators”). Antibodies are special proteins that lock onto specific antigens. Each B cell makes one specific antibody, for example, one fights the bacteria that causes pneumonia, while another recognizes the common cold virus. Antibodies are a part of a large family of chemicals called immunoglobulins, which play many roles in your immune response.



IMMUNOGLOBULIN G (IGG)
marks microbes so other cells can recognize and deal with them.

IGM
Is expert at killing bacteria.

IGA
Protects against parasites and is also to blame for allergies.

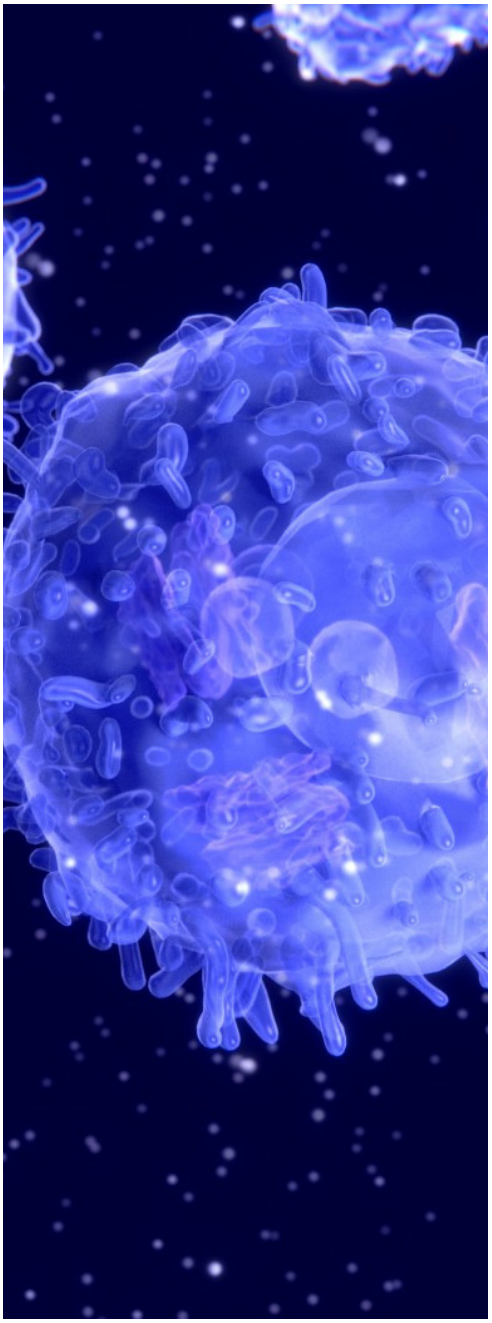
IGD
Stays bound to B lymphocytes, helping them to start the immune response.

IGE
Protects against parasites and is also to blame for allergies.

Antibodies lock onto the antigen, but they do not kill it, only mark it for death. The killing is the job of other cells, such as phagocytes.

THE ROLE OF T LYMPHOCYTES

THERE ARE DISTINCT TYPES OF T LYMPHOCYTES:



HELPER T CELLS (TH CELLS)
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, 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.

IMMUNITY

Everyone's immune system is different but, as a general rule, it becomes stronger up to adulthood when we have been exposed to more pathogens and developed more immunity.

That's why teens and adults tend to get sick less often than children.

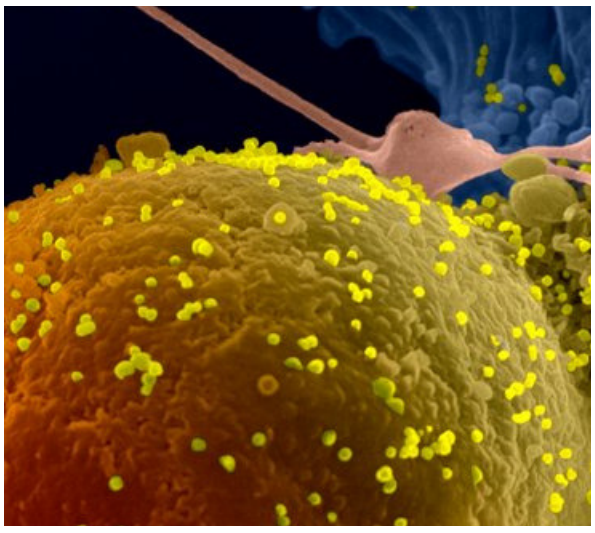
Once an antibody has been produced, a copy remains in the body so that if the same antigen appears again, it can be dealt with more quickly.

This is why with some diseases, such as chickenpox, you only get it once as the body has a chickenpox antibody stored, ready and waiting to destroy it next time it arrives. This is called immunity.

There are three types of immunity, innate, adaptive, and passive.

INNATE IMMUNITY

We're all born with some level of immunity to invaders. Human immune systems, similarly to those of many animals, will attack foreign invaders from day one. This innate immunity includes the external barriers of our body—the first line of defense against pathogen—such as the skin and mucous membranes of the throat and gut. This response is more general and non-specific. If the pathogen manages to dodge the innate immune system, adaptive or acquired immunity kicks in.



ADAPTIVE (ACQUIRED) IMMUNITY

This protect from pathogens develops as we age. As we are exposed to diseases or get vaccinated, we build up a library of antibodies to different pathogens. This is sometimes referred to as immunological memory because our immune system remembers previous enemies.

PASSIVE IMMUNITY

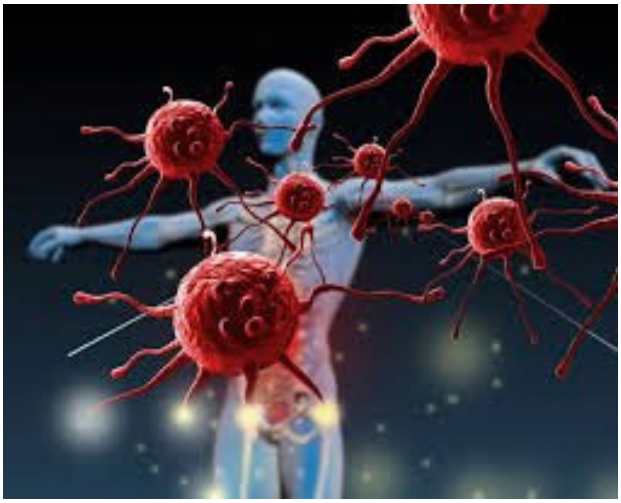
This type of immunity is "borrowed" from another source, but it does not last indefinitely. For instance, a baby receives antibodies from the mother through the placenta before birth and in breast milk following birth. This passive immunity protects the baby from some infections during the early years of their life.

IMMUNE SYSTEM DISORDERS

Because the immune system is so complex, there are many potential ways it can go wrong. Immune disorders 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, such as age, obesity, and alcoholism. In developing countries, malnutrition is a common cause. AIDS is an example of an acquired immunodeficiency. In some cases, immunodeficiencies can be inherited, for instance, in chronic granulomatous disease where phagocytes do not function properly.

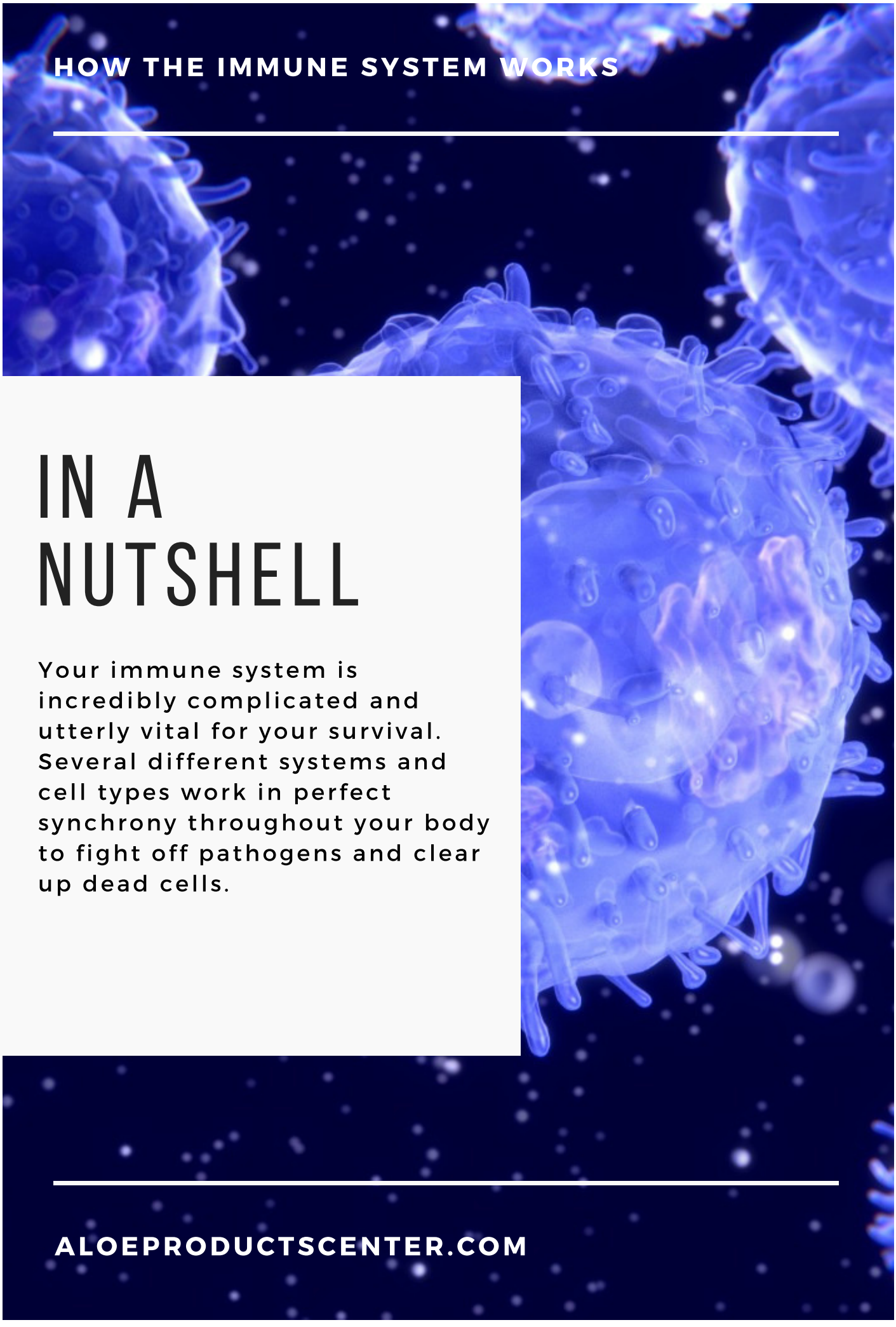


AUTOIMMUNITY

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

HYPERSENSITIVITY

With hypersensitivity, the immune system overreacts 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.



IN A NUTSHELL

Your immune system is incredibly complicated and utterly vital for your survival. Several different systems and cell types work in perfect synchrony throughout your body to fight off pathogens and clear up dead cells.

ABOUT THE AUTHOR, TIM NEWMAN

After completing a Neuroscience degree at the University of Manchester, Tim widened his interests to include all things medical. As News Editor at MNT, Tim leads a team of fantastic writers and editors working to bring you the latest medical research from peer-reviewed journals on a daily basis. When he gets the chance, he enjoys playing the drums in a metal band, birdwatching, attending medieval jousts, and wrestling with his children.

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Dr. Daniel Sallis Murrell is an associate professor specializing in internal medicine and infectious disease. He graduated from the University of Tennessee Health and Science Center in 2014 with his degree in medicine.

He recently completed his residency at the University of Illinois at Chicago. Dr. Murrell is also an urban health program mentor. His personal interests include brewing beer, childrearing, and literature.

Originally posted at: https://www.medicalnewstoday.com/articles/320101.php