

The **IMMUNE**  
System

*Your* Line of Defense





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# How Your Immune System Defends You

You're intricately connected to the world that surrounds you, not only at a social and cultural level but at a cellular level. Without you even realizing it, your body is constantly interacting with microbes—trillions of different life forms invisible to the naked eye.

It's not until you start feeling under the weather, get a mosquito bite, or cut your finger that you begin to think about the many microbes that live on every surface and every niche ... even inside and on you.

To keep you strong and healthy, your body's collection of cells and proteins know how to differentiate between you and everything else that is not you, so you can go about your day not worrying about microbial interactions. And your immune system regulates that process.

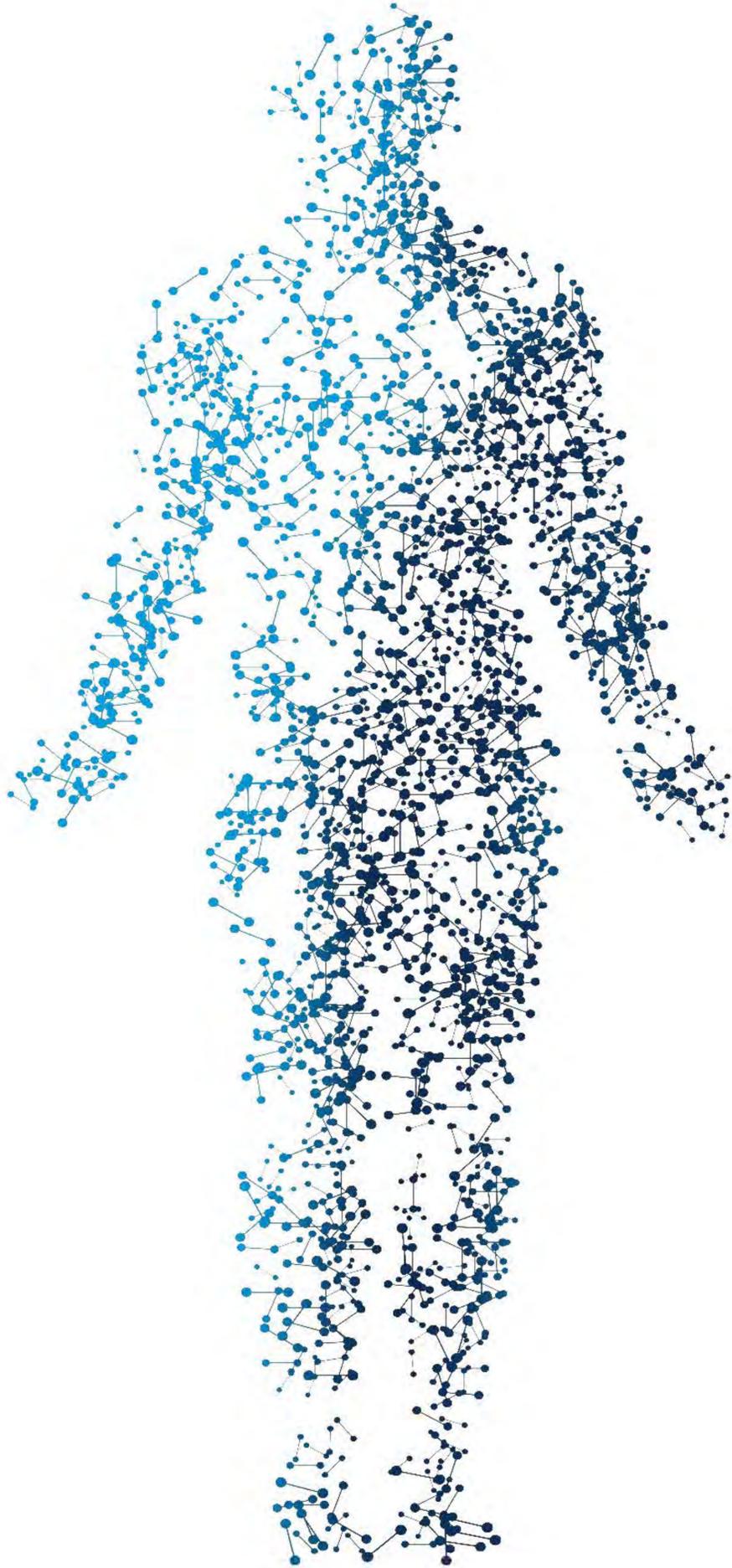




## What Is the Immune System?

Your immune system is your defense against foreign invaders (pathogens responsible for diseases and infections), antigens (anything that's not you that can trigger an immune response) and damaging substances—all living organisms have a defense system.

The immune system for mammals and other large animals, such as birds and reptiles, consists of the innate and adaptive immune systems.<sup>1,2</sup>



## Two Lines of Defense

**1. Innate Immune System:** This is your first response system, protecting you against pathogens and antigens nonspecifically, which means it hasn't been exposed to pathogens and consequently doesn't recognize them individually.<sup>2</sup> Think of an "all or nothing" approach. It does this in several ways:

**a. Physical and chemical barriers:** Your body is designed to protect itself—from your skin to the lining of your respiratory and GI tract, to your stomach acid. Together, they provide a barrier against invaders.<sup>1,2</sup>

**b. Phagocytic white cells:** These are immune cells that engulf and kill invading pathogens and activate adaptive immunity, which is your defense against specific antigens.<sup>1,2</sup>

**c. Natural killer cells (NK):** These are white blood cells that destroy virus infected cells; they even target tumor cells.<sup>1</sup>

**d. Acute-phase proteins:** These proteins are involved in adaptive immunity (target specific antigens) and participate in inflammation.<sup>3</sup>

**2. Adaptive Immune System:** As its name suggests, the adaptive immune system responds specifically to individual antigens in two different ways: through antibodies and through T-cells.<sup>2</sup>

**a. Antibody-mediated immunity:** This process involves B cells, which are made in the bone marrow; they secrete antibodies that recognize antigens, microorganisms or allergens. The antibodies then help destroy these undesirable invaders.<sup>2</sup>

**b. Cell-mediated immunity:** This process relies on T cells. They are also made in bone marrow, but they mature in the thymus gland.<sup>2</sup> There are three types:

**i. Helper T cells:** As the name implies, these cells help other immune cells recognize and destroy infectious microorganisms and infected cells.<sup>2</sup>

**ii. Cytotoxic T cells:** From cyto, meaning cell, cytotoxic T cells kill foreign, infected and abnormal cells.<sup>2</sup>

**iii. Regulatory T cells:** These cells regulate the immune response and protect you against an overreaction from your immune response.<sup>2,4</sup>



Cell aging, or immune senescence, is the decline in immune function that occurs at a cellular level

## Cell Aging and Immune Function Decline

The immune system interacts with microbes, regulates cell communication and plays a key role in your overall health and function. But all that constant work takes a toll over time.

Cell aging, or immune senescence, is the decline in immune function that occurs at a cellular level and immune senescence in large organisms is characterized by:

**1. Naïve T cell decline:** Naïve cells are young immune cells ready to fight. You'll have fewer cells available to respond to new antigens that you encounter throughout your life.<sup>5</sup>

**2. Increase in senescent memory T cells:**

Although memory T cells help develop immunity, over time, these cells become dysfunctional and secrete inflammatory factors.<sup>6</sup>

**3. Functional natural killer (NK) cell activity decline:** NK cells are powerful frontline defenders against infection. The number of NK cells may actually increase with age; however, proper function of these cells declines. This means the body is less able to fight infection.<sup>7</sup>

**4. Thymus atrophy:** The thymus, a gland where T cells mature, shrinks with aging. This results in fewer naïve T cells and reduces the body's ability to respond to new threats.<sup>8,9</sup>

**5. Interleukin-6 overproduction:** Interleukins are types of proteins made by white blood cells to help regulate the immune response. Although interleukin-6 (IL-6) is crucial for a healthy inflammatory response, high levels of IL-6 during aging have been associated with a greater risk of some diseases and premature mortality.<sup>10,11</sup>

**6. Infection with cytomegalovirus:** This virus is responsible for chickenpox and mononucleosis (mono). The virus infects a majority of people and after infecting a person, the virus stays in the body for life, but the immune system keeps it in check. That lifelong interaction takes a toll on the immune system and it's often expressed as an imbalance of memory T cells to naïve T cells.<sup>12</sup>

## How You Can Help Your Immune System

Though immune function tends to decline over time, all is not lost. You can help maintain healthy immune function — no matter how old you are— by living a healthy lifestyle and ensuring an optimal intake of specific vitamins, minerals and amino acids.



# LIFESTYLE HEALTHY HABITS

**A. Lifestyle and healthy habits:** A healthy diet, regular physical activity, knowing how to manage stress and getting quality sleep can go a long way toward supporting a healthy immune system.

**a. It's all about portions and nutrition:** Eating the right portions of nutrient-dense foods, that promote optimal nutrition, such as those found in a Mediterranean diet, has been associated with better immune function, including less unhealthy inflammation in animal and some human studies.<sup>13-15</sup> The Mediterranean diet has been associated with a reduction of inflammation markers and is characterized by a high intake of olive oil, fruit, vegetables, legumes, whole grains, nuts and seeds; moderate amounts of fish, poultry, cheese, yogurt, eggs and alcohol, and a

low intake of red meat, cured meat products and foods that contain refined sugars.

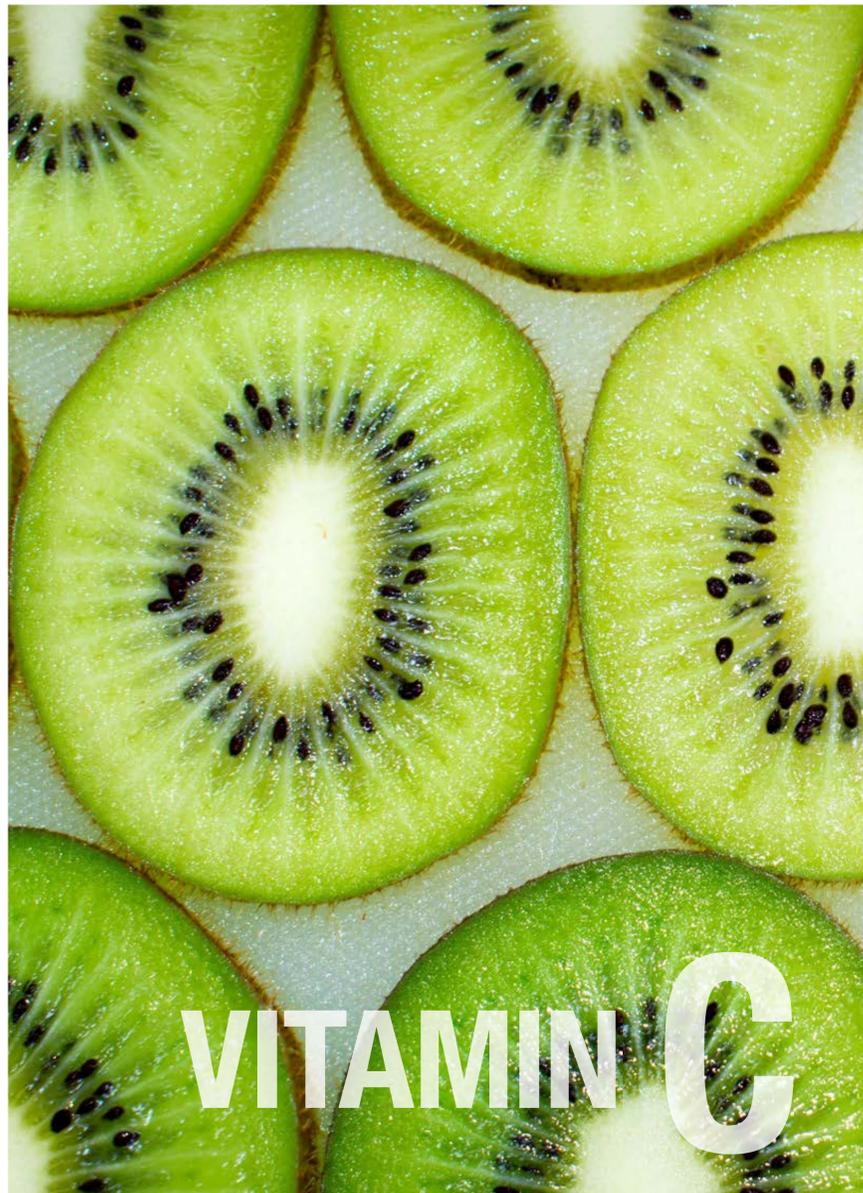
**b. Staying active:** Regular, moderate, physician-approved exercise helps maintain healthy immune function.<sup>17,18</sup> And you don't have to spend hours at the gym or doing an exercise you don't like; just get your body moving 3-4 times a week for a minimum of 30 minutes a day.

**c. Say no to stress:** Stress can hamper immune function; learning to manage stress may reduce this effect.<sup>19,20</sup>

**d. Get your ZZZs:** Adequate amounts of consistently-timed sleep helps support the immune system.<sup>21</sup>



The Mediterranean diet has been associated with better immune function



# VITAMINS & MINERALS

**B. Vitamins and minerals:** As essential micronutrients, vitamins and minerals are among the building blocks of the body's systems, including the immune system.

**a. Vitamin C:** This vitamin stimulates the immune system, participates as an anti-inflammatory and has antiviral and antibacterial properties.<sup>22</sup>

**b. Vitamin D:** This vitamin regulates the adaptive immune response.<sup>23</sup> Research has shown an

association between an impairment of immune function and vitamin D deficiency.<sup>24</sup>

**c. Zinc:** This mineral contributes in maintaining a healthy immune system, among many other functions. A deficiency in zinc, which is frequently observed in older individuals, is associated with inflammation and immunosenescence.<sup>25</sup>

# FOODS, HERBS & HORMONES

**C. Foods, herbs & hormones:** Some foods, herbs, and hormones have been associated with immune system support in experimental and human research.

**a. *Andrographis paniculata*:** The herb *Andrographis paniculata* has improved several aspects of immune response in mice with cancer while decreasing proinflammatory cytokines.<sup>26</sup> Research suggests it may also improve vaccine effectiveness.<sup>27</sup>

**b. Beta-glucan:** These long chains of carbohydrates, found in certain mushrooms, have been shown to be beneficial for proper immune function.<sup>28</sup>

**c. Cistanche:** Preclinical studies have shown that this herb increased naïve T cells and natural killer cells in addition to other immune-related benefits, which suggests that the herb can induce age-related immunosenescence reversal.<sup>29</sup>

**d. DHEA:** The hormone dehydroepiandrosterone (DHEA) plays a role in immune system function by opposing the immunosuppressive effect of the adrenal hormone cortisol.<sup>30</sup>

**e. Enzymatically modified rice bran:** Enzymatically modified rice bran enhances the number and function of natural killer cells and other immune cells.<sup>31</sup>

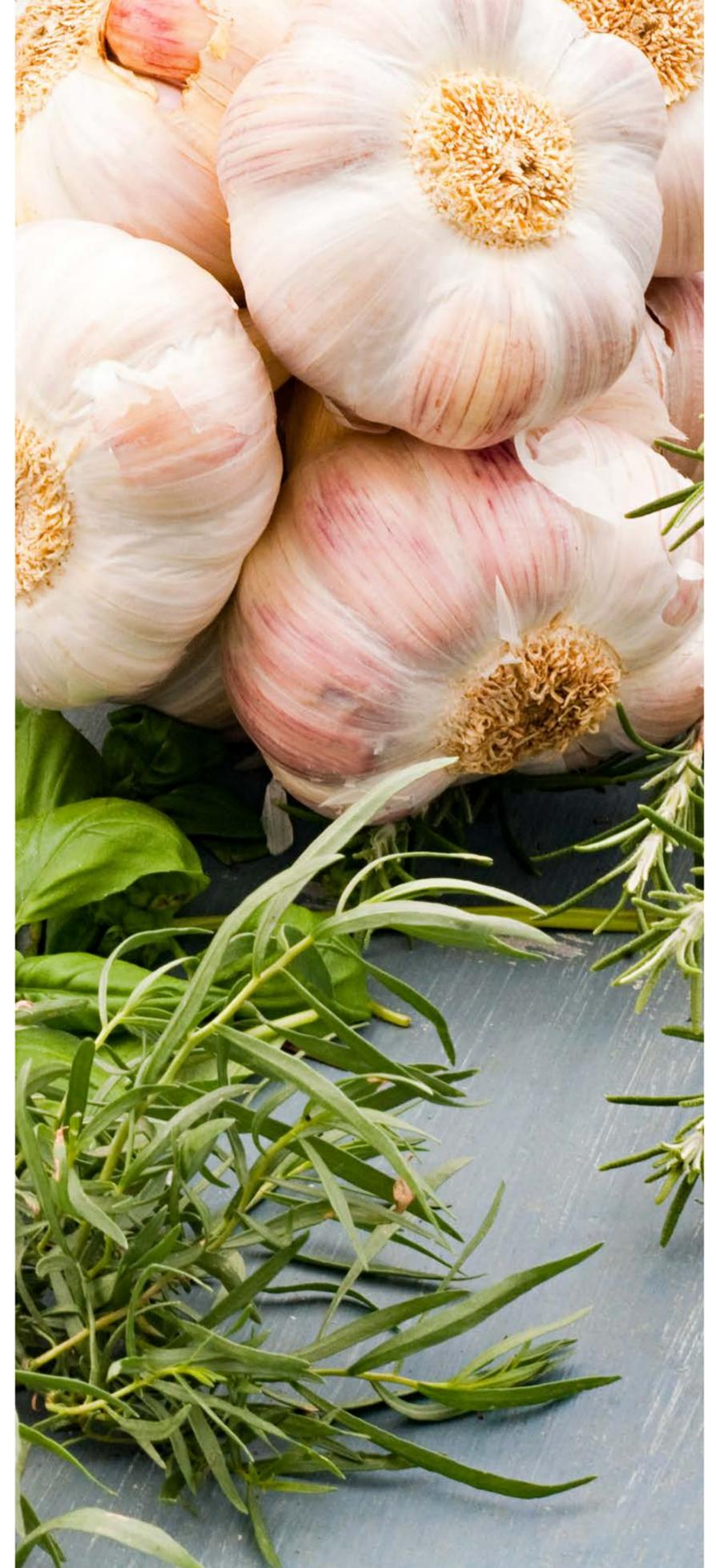
**f. Fucoidan:** Derived from brown seaweed, fucoidan has immune-modulating, antiviral, anti-tumor and anti-inflammatory properties.<sup>32</sup>

**g. Garlic:** This popular herb is a well-known home remedy for colds and flu, has immune modulating, immunostimulatory and anti-tumor effects.<sup>33</sup> A review and meta-analysis concluded that garlic increases macrophage activity, natural killer cells and B and T cell production, while also helping to reduce duration and severity of upper respiratory infections.<sup>34</sup>

**h. N-acetyl cysteine:** This nutrient contributes to the regulation of innate immunity and is needed by T cells and other immune cells.<sup>35</sup>

**i. *Tinospora cordifolia*:** This herb has a compound that modifies immune response and function.<sup>36,37</sup>

**i. Whey protein:** Made from cow's milk, this nutrient has been shown in studies to improve vaccine response and activate immune cell function.<sup>38,39</sup>





# Did You Know

## There Are Some New Treatments for Immune System Aging?

New and emerging interventions that counteract aging-related immune decline are showing promise in recent research.

### 1. Granulocyte-Colony Stimulating Factor (G-CSF):

This protein is a growth factor that stimulates the production and maturation of a common type of white blood cell known as neutrophils.<sup>40</sup>

### 2. Senolytic Activators:

**a. Quercetin plus dasatinib:** Combining the nutrient quercetin with the drug dasatinib could help prevent the damaging inflammation caused by senescent cells.<sup>41</sup>

**b. Theaflavins:** Found in black tea, they help protect against inflammatory disorders, as well as bacterial and viral infections.<sup>42</sup>

# Did You Know

Practicing meditation regularly can be beneficial for the immune system.

A review of 45 studies found that meditation lowers cortisol output, blood pressure, heart rate, triglycerides and inflammatory marker levels, indicating its potential for protecting cardiovascular health.

This is important as high cortisol levels can dampen a healthy immune response.<sup>43</sup>





## Strengthen Your Immune System One Step at a Time

The immune system is your defense against any harmful microbes you may encounter. Maintaining a healthier lifestyle will not only support your immune system—it will improve your quality of life.

If the idea of overhauling your diet, launching a fitness routine or starting a mental wellness routine is overwhelming, understand that any improvements will help. Start with small adjustments and build over time. Remember, marginal and consistent changes will yield the best results.

There's no due date—this journey is about enhancing your lifestyle to support your immune system and overall health, so you can live your healthiest life.

### Have a health question?

We have the answers... You can speak with a Life Extension Wellness Specialist toll-free at 1-800-226-2370. This informational service is staffed by doctors, nurses, and other health practitioners and is free.



[LifeExtension.com](http://LifeExtension.com)

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