

THE SECRET TO HEALTHY IMMUNE CELLS



THE FATTY ANTIOXIDANT SOLUTION

✓ *Science-Based*

✓ *Nutrition & Natural Immunity*

JORG WIJNEN

**THE SECRET
TO
HEALTHY IMMUNE CELLS:**

THE FATTY ANTIOXIDANT SOLUTION

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Your Free Book is Waiting

This book explores the accuracy of world's most common home remedies for viral infections—including COVID-19—and their prevention. Have you ever felt confused about what works and what doesn't? Or what's true and what's not? If so, then this book will create much more clarity for you.

Download a free copy of
COVID-19 Home Remedies and Prevention: Myths & Truths here:

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Note to Reader

Don't let its size, and the lack of a price tag, deceive you. This book contains valuable, science-backed tools that can help support your immune system, your health and your wellbeing. As a dietitian who holds lifestyle medicine in high regard, I've personally seen these tools work with great effect in anyone who put them into practice, including myself. I hope more and more people will discover them and reap the benefits.

I feel public information regarding immune health is lacking and I wish this information becomes widely and freely available. To do this sustainably, I have used a very significant component of *Immunity Hi, Virus Bye-Bye*—my most extensive work on immune health—for the foundation of this book: *The Secret to Healthy Immune Cells*. However, I've made sure that **this book can easily stand on its own and doesn't require you to read *Immunity Hi, Virus Bye-Bye***. Of course, I'd be thrilled if you were interested in reading it, but I firmly believe *The Secret to Healthy Immune Cells* provides you with enough value to start optimizing your immune system and your health. As an extra, I've added an Appendix that complements the antioxidant sections of this book. Here, you have access to the most exhaustive antioxidant list available and learn how to make best use of it.

With that said, *Immunity Hi, Virus Bye-Bye* is a more comprehensive book on how to optimize your immune health and, naturally, has even more to offer for anyone who desires to obtain the maximum benefits. Furthermore, the sales from the book allows me to create more free and helpful content such as this. If you want to learn more about *Immunity Hi, Virus Bye-Bye*, find it on Amazon or visit my author website www.jorgwijnen.com for up-to-date information. For other books about health, wellness or the immune system—that I recommend personally—see the last section of this book: [Recommended Books](#).

I wish for you to receive tremendous joy and satisfaction on your journey of health and wellbeing.

Disclaimer

This book contains examples which include both fictional and nonfictional characters. Any resemblance to actual persons is therefore not necessarily coincidental. Identities of real people described in the examples have been changed to protect their privacy. Space and time have been rearranged to suit the convenience of the book.

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Words of Caution

The dietary and lifestyle strategies given in this book are aimed towards improving your immune health, but because of their direct impact on other health components, they are also very effective at improving various underlying health conditions. If you are taking any medication, especially medication for diabetes or high blood pressure, do not make dietary changes without the assistance of a physician, as your medication will require adjustment to prevent excessive lowering of your blood pressure and blood sugar levels. This could otherwise lead to dangerous situations. Therefore, any medication you take for either of these conditions will need to be adjusted and, with time, maybe discontinued.

The health message in this book empowers you to take control of your own health.

Some of the information in this book may also upset anyone who has strong food preferences, food addictions and deep-rooted beliefs about health. Our attachments to food can result in strong opposition and disbelief, regardless of the evidence presented. It may be that some topics will resonate with you, and some won't. I hope that you can keep an open mind and explore all options before you reach a conclusion. In the end, we all share a common goal. We all want to be healthy and happy.

If I can make even the slightest contribution to your journey of happiness and wellbeing, I am deeply grateful.

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Introduction

We're clever beings. We have may have outwitted natural selection; our life expectancy has increased by around thirty years over the last hundred years. Lucky for us, chances of dying from infection have dropped significantly during that time. However, natural selection is relentless in its quest to pressure our immune systems to their maximum, whenever it has a chance.

Although infectious diseases aren't our main causes of death anymore—unlike in the past—they still have the ability to cause misery and death. COVID-19 is just one of many possible threats.

We are in no position to underestimate any emerging infectious diseases. They have as much potential to shape future human history as the epidemics and pandemics of the past. Managing this threat at the root depends on our understanding of our sophisticated immune system and how to optimize it.¹ Not only that, the top killers of today such as cancer and heart disease, can only develop when the immune system doesn't function optimally.^{2, 3, 4}

Neglecting our immune system is like building a house—that isn't earthquake-proof—in the middle of an earthquake zone.

Instead of waiting and hoping for the best, we should start building a solid foundation upon which we build the right structure that can withstand assaults from earthquakes to prevent our house from collapsing. Similarly, if we optimize our foundation, or our immune system, it protects our structure, or our body, from known and yet unknown, viruses and pathogens that are lurking in the darkness. The question's not whether they exist, but rather, when they decide to come out and show themselves. As National Geographic reported:

“There are as many as 1.6 million viruses we know nothing about lurking in mammals and birds, and as many as half might have the potential to jump to humans and infect us.”⁵

Any type of invader that attempts to pass our defenses will ideally be met by our immune system's patrol officers; the immune cells, or white blood cells. They form the basis for our immune system. It has different facets, but virtually all of them are—in one way or another—connected to these immune cells.

What can you expect to find in this book?

The first part creates a basic understanding of the immune system and its immune cells; what they are composed of and what are their weaknesses and their strengths. The next part explains how to meet their needs and how to keep them in optimal condition so that they can do what they are designed to do: eliminate invaders and keep us safe.

Chapter 1

The Importance of Our Immune System



Chapter 1

The Importance of Our Immune System

Do we really need an optimal working immune system? No, we don't. As a matter of fact, many of us are living with an immune system that doesn't work optimally at all. Unfortunately, too many people get cancer or heart disease during their lifetime. Many of us get sick easily, and more often than we would like, which is, especially during a global pandemic, something we would like to avoid. How is all this relevant?

A well-functioning immune system is essential to our health. Our immune system protects us, through a variety of mechanisms, from infections caused by viruses, bacteria, fungi *and* parasites.¹ But it goes beyond that: our immune system is closely connected to a multitude of chronic diseases, such as cancer and cardiovascular diseases.^{2, 3, 4}

The immune system's ability to adapt to strange environmental changes is critical in fighting off infections. The coronavirus is one such strange environmental change to which our bodies are forced to respond.

Immune systems have an uneasy relationship with the environment. Most of the time, an encounter with something new is harmless, but a small number of times it can be potentially dangerous. An effective immune system must be able to make a distinction between harmless and dangerous, and it must be able to distinguish self from non-self.⁵

This is crucial, because our immune system has a variety of mechanisms that are able to destroy a wide range of microbial cells and toxic substances. This can lead to problems as well. One such problem might be that our own immune system starts attacking our own body, which could lead to autoimmune disease, among others.¹

What about the people who died from COVID-19? Contrary to what many of us believe, they didn't die from the virus that caused it, SARS-CoV-2. In fact, it was their own immune system that violently reacted with an inflammatory immune response, which led to severe breathing problems and multiple organ failure.⁶ The tragic story of Keith Gambrell reminds us how serious it can be when the immune system doesn't respond optimally. Keith lost his grandfather to COVID-19. Unfortunately, that wasn't all. Keith lost his father just a few hours after his grandfather passed away. The most tragic part was that three different hospitals denied his father assistance in the days before his passing.⁷ It's easy to speak in hindsight about how things could have or should have gone down, but this does raise a question of concern: how can we prevent this kind of situation from occurring in the first place? This book will answer this question and hopefully take away any fear or anxiety that may be present.

The importance of a well-functioning immune system cannot be understated: it is able to target real threats while avoiding harm to the host's own tissues.¹ Even though only a minority will suffer complications, everybody will benefit from having an optimal immune system for all the reasons mentioned so far.

How a Virus Infection Gets Started

The cells in our body are performing tasks nonstop. They are like little power plants that supply a constant amount of energy to their environment. That energy then translates into "electricity" which we use in our everyday life. It allows us to take a hot shower, to store our food in a refrigerator, to cook, and to see where we are going at night. Imagine how we would fare without that energy. How well would you still be able to take care of yourself? Would you still take a shower when the water is freezing? Would you still eat fresh produce, or would you resort to less healthy options? Would you be able to cook? And would you be able to stay safe and not walk into a wall at night? It's dark, after all.

With an appreciation for what we have, perhaps we can also develop an appreciation for our very own cells that make life as we know it possible. Cells are crucial to our existence. Whenever a tissue or organ is growing, or whenever damaged tissue has to be repaired or replaced, cells divide or reproduce.⁸ The reproduction of cells is a natural process, essential to our survival.

If it wasn't for cells being able to divide and reproduce, life as we know it would simply not be possible. We couldn't use our muscles to move around, or even to stay alive for that matter, because our organs would simply fail. That means that our heart would stop beating altogether.

From the moment we are conceived, cells start dividing and reproducing. It is most evident in our growing phase during childhood. But even at an older age, long after we've stopped growing, cells continue to divide and reproduce, because there are always tissues that need to be repaired or replaced.

Where do infections fit in all this?

Infections can arise at any time, and they can reproduce as well. They can, however, reproduce much more rapidly than normal cells.

In the same way, COVID-19 and other virus infections can arise at any time and start reproducing. Have you ever had a song in your head that kept repeating itself over and over again? That's what we call an "infectious" song. If the "infection" is strong enough and you succumb to it, you will find yourself having no choice but to sing it out loud, repeatedly. In the process, there's a good chance that you could infect others as well. Before you know it, multiple people are singing together, subjugated by the song. Sometimes, like a virus, you don't even know how you got infected by it in the first place. Even if you backtrack your steps, trying to figure out from where it originated, it's already too late.

If the infection is caused by an actual virus, the virus hijacks a cell and starts to produce copies of itself, like the infectious song that seemingly starts to produce copies of itself within your brain.

The difference between how viruses operate versus normal cells is that the reproduction by viruses (and songs) is not life-supporting. Worse than that, if left unchecked, virus reproduction would result in our own death. In order for a virus to keep reproducing, it can change its appearance and can evade recognition by the small little guardians of our immune system, the white blood cells.

Therefore, it's absolutely essential to have an optimal working immune system. An effective immune system must be able to deal with this unpredictability.⁵

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An immune system is much more than just a tool in preventing and dealing with viral infections.

A good working immune system will also offer you more protection against cancer over the long term, because there is always a small chance that cells undergo a mutation upon dividing.⁵ And tumor growth is initiated by mutations like these.¹⁰

Since cancer is one of our top killers, there is a lot of benefit to be gained from having a good immune system.

The Members of the Security Team

Throughout this book, the immune system is mentioned frequently in a fairly straightforward manner. However, it would be an injustice to our immune system to not briefly explain how it consists of two fascinating subsystems. The first is called the innate immune system, and the second is called the adaptive immune system. Together, they form the impeccable security team of our establishment, the body.

To begin with, we will look into the two parts separately, before using an analogy to describe their proficient and harmonious cooperation.

Innate immunity serves as the first line of defense against invading pathogens, like viruses, and plays a key role in shaping the adaptive immune response that follows.¹¹

We could see our innate immune system as our most basic defense system. It is pretty straightforward in the way that it sends out specific immune cells to any place in our body which is being invaded by pathogens. These cells have the ability to engage in combat and neutralize the offenders. This innate immune system, although quite effective, is also fairly primitive, for it can't retain any memory of past events.

If the pathogens can't be eliminated, then the adaptive immune system comes into play, which sends out other types of immune cells. The adaptive immune system is a bit more sophisticated, because it can remember specific details of the pathogens that invade us and it uses that information to combat them more efficiently. This memory also allows us to not get invaded by the same pathogens twice.⁵

Here's an analogy to explain in simple terms how our immune system operates.

An immune system is like a group of bouncers, or a security team, who work for a high-end establishment and who stop unwanted guests from entering and causing trouble. The establishment could be seen as our body. Now, a good bouncer, comparable to our innate immune system, can stop a lot of people from entering who would otherwise have caused trouble. In the same way, our innate immune system can stop and eliminate viruses and prevent them from causing issues.

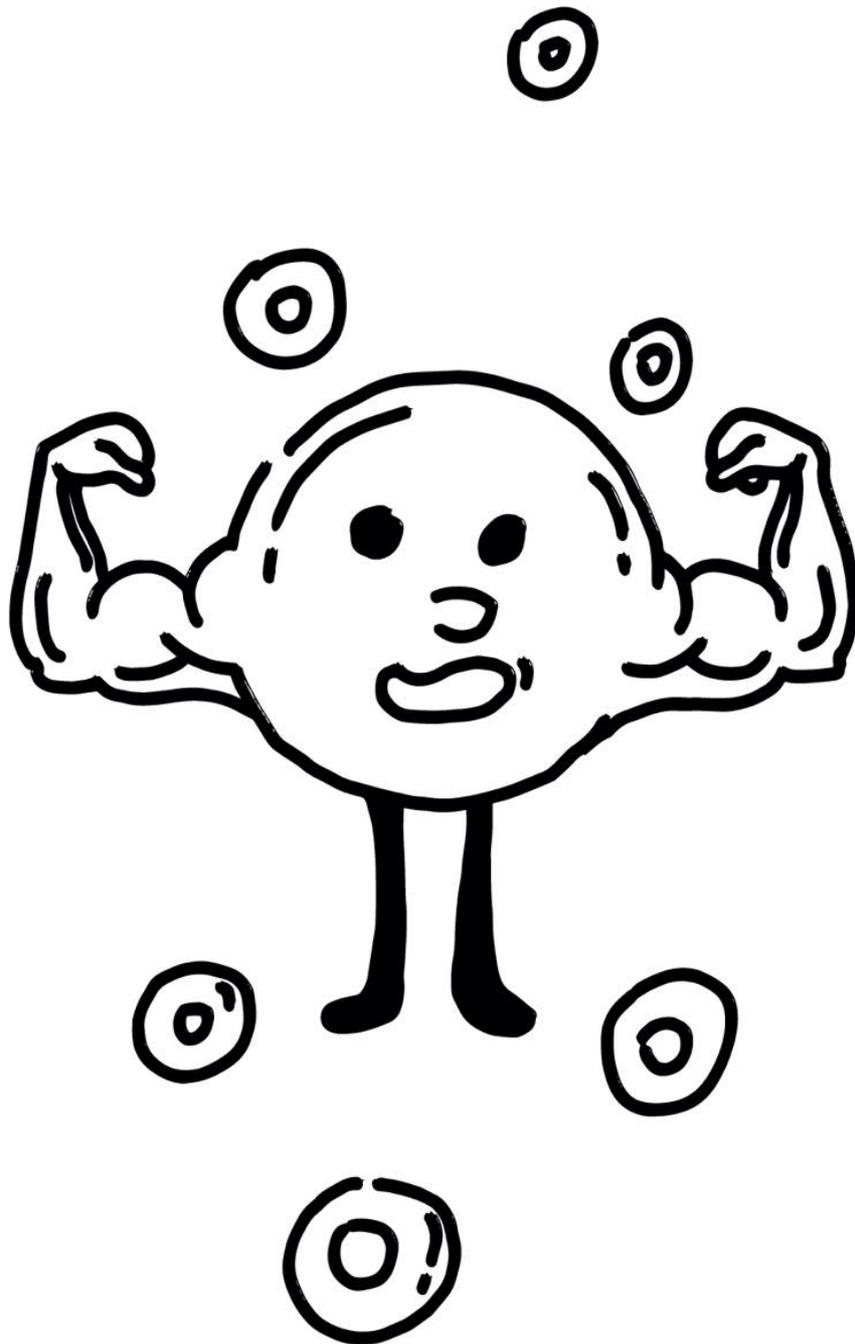
A situation may arise where an unwanted individual still finds his way into the establishment by passing security, like a virus can still make its way into our bodies undetected by our innate immune system. A good security team is always on the lookout for unwanted and suspicious-looking guests and maintains an excellent communication network, allowing specific actions to be taken depending on the situation at hand, just like our adaptive immune system. Strange or unwanted behavior by guests results in members of the security team taking immediate action. This high-end establishment cannot afford risking its precious reputation, which

might hurt its business. Some members of the security team, like our adaptive immune system, will make sure guests that have been shown the door are never able to come back again. Pictures are taken, IDs are photocopied and, for good measure, fingerprints are taken as well. Our adaptive immune system has an excellent memory to protect itself from pathogens and viruses that have already come into contact with us.

Bottom line: Our immune system is a state-of-the-art security system which is not only able to protect us from virus infections, but also from a variety of chronic diseases. If we take care of it, it will take care of us.

Chapter 2

Optimizing Our Immune Cells



Chapter 2

Optimizing Our Immune Cells

2.1 Strengths and Weaknesses of Immune Cells

It's ironic. The cells that form our immune system are put in place to protect us from danger. Yet, if circumstances aren't right, they can commit friendly fire and harm us. Sometimes, the harm can be irreversible. Immune cells, or white blood cells, are soldiers that are continuously sent on missions to eliminate the enemies while protecting the innocent. In order for soldiers to complete a mission, they require two things:

1. Optimal health
2. A flawless communication network

If a soldier isn't healthy enough, the mission is in danger of failing. If there is anything that disrupts communication, soldiers might be misguided and miss their target, harm innocent people, or both.

There are various white blood cells, each performing their own specific duty within our immune system, just as soldiers have their own individual tasks and responsibilities. The goal for our immune cells is to protect their host, us, against a multitude of pathogens, like harmful bacteria and viruses.¹ They are also responsible for taking care of any abnormal cell development, which is a cause for the development of cancer.² The question therefore becomes: how can we meet the needs of our immune cells so that they can function optimally and protect us under all kinds of circumstances?

In answering this question, we need to inspect the fascinating miniature factories that we call immune cells. All immune cells are covered by a thin layer called a membrane. This layer is the key to how a cell operates within its environment, where it is able to gather things the cell needs, let go of the things the

cell doesn't, and, at the same time, protect the cell from things that can damage it.³ By supporting this miraculous, microscopic membrane, we allow our immune cells to do their job and protect us.

Immune cells possess many protective functions, and these largely depend on one very important thing: cell membrane fluidity.⁴

To perform at its best, an immune cell must be able to take action at any time and must be able to communicate with other cells to stay up-to-date on the latest threats hovering on the horizon. If the immune cell's membrane loses its integrity and fluidity in any way, all these cell functions will be impaired.⁴

Many of us work, or have worked, at home due to lockdown and isolation protocols. For our workplace, company or business to continue operating successfully, we need to communicate with our team members, colleagues, supervisors, staff, etc.

How can we sustain this communication network? With the help of communication tools such as computers, phones and the internet.

Imagine how it would affect our work if there was a long-term internet disruption, or a power cut within the entire city. This would certainly affect the quality of our work. It may have even more serious consequences. This is how important the cell membranes are for our immune cells. These membranes are like a communication network, necessary for our immune cells to do the work that is needed to protect their host—us—in the best way that they can.

Fluidity of an Immune Cell

We know that membranes have “fluid” properties, which are needed to sustain the proper workings of our immune cells. It would help us greatly if we knew how this fluidity arises so that we can provide for its maintenance. What do the membranes consist of?

Membranes are mostly made up of phospholipids.⁴ These lipids are, in turn, mostly made up of fatty acids.⁵ And, it is this “fat” that gives the cell membrane its

fluid character.¹ Since fat is such a vital component, does that mean that fat in the diet is also important? Yes, and no. Not all types of fat are created equal. The type of fat which the immune cells prefer is polyunsaturated fatty acids, like omega-3 and omega-6.⁶ They can be found in some plant and animal sources, such as olives, nuts, seeds, avocado, fish and various oils. The best sources of these fats are discussed in Chapter 2, section 5: “Essential Fatty Acids.” But first, why are these unsaturated fats preferred over saturated fats?

Imagine frying something in butter or solid margarine, which are both rich in saturated fat. After you are done frying, you serve your food on a plate and eat your meal. Some liquid fat residues remain in the pan. After you finish your meal, you get ready to do the dishes. You look in the pan and notice that the fat has turned solid. Saturated fat turns solid at room temperature and only liquifies when heated, hence the solidification when the temperature drops.

Unsaturated fats, on the other hand, are fluid even at room temperature due to their molecular structure. This fluid character is crucial for immune cells to make their way around our body. We could compare the lack of fluidity of an immune cell to wearing an astronaut suit to go to work. The suit would severely limit our mobility because of the total mass of the suit. On top of that, the suit would also slow us down considerably because of its immense weight. Astronaut suits are approximately 110 pounds (fifty kilograms).⁷

The fluid nature of the lipids provides our immune cells with significant advantages, but they also have a major drawback: they are very sensitive to peroxidation.⁴

Lipid peroxidation is the oxidative degradation of lipids. It can happen to the fat of our immune cells, but also to fat found elsewhere, like in our food for example. Have you ever enjoyed snacking on nuts, when all of a sudden you bite into one that is so foul you need to spit it out at once? That nut was a victim of oxidation and had turned rancid. The oxidation can not only be tasted but also smelled. Think of an eatery or a restaurant using rancid oil in the kitchen. The smell is so penetrating that

it hits you the moment you open the door and step inside. If you ever feel tempted to order french fries in a place like this, you may want to reconsider.

Why? Before we can answer that, we need to understand why this oxidation happens in the first place. The lipids are attacked by something called free radicals, which “steal” electrons from the lipids in cell membranes. The lipids basically lose an essential part of their structure, which makes them unstable.⁸ When our food comes into contact with light, heat or oxygen, free radicals are produced and negatively affect the quality of the fat and the food of which it is part. Although we can’t compare our immune cells directly to food, we can compare the damage that occurs by free radicals because our immune cells also come into contact with free radicals, as explained in the next section.

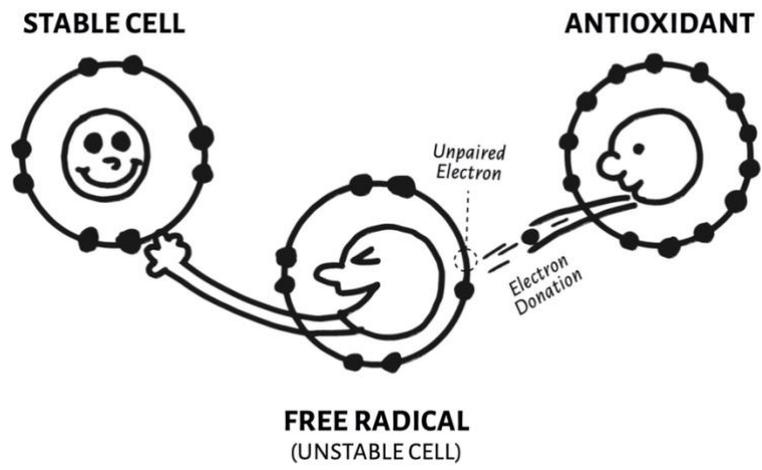
When the membrane of the immune cell is damaged, its fluidity and integrity is impaired. Because they are the foundation of our immune system, these events adversely affect our immune response.⁴ These free radicals can sabotage the communication network of immune cells, as hackers can sabotage our communication tools, making us unable to communicate with colleagues and friends, and unable to receive any important emails and messages.

Bottom line: The miraculous little factories we call immune cells rely on their vital membrane for improved mobility and internal communication to successfully engage and eliminate any intruders. Membranes are their strength but, paradoxically, also their weakness, as the membrane is vulnerable to attacks by free radicals.

2.2 Consequences of Free Radicals

Free radicals can cause severe damage, and yet, they aren’t inherently bad. In fact, they can save our lives. Like hackers, they also possess good qualities, provided the circumstances are right.

The answer to why a free radical causes instability and damage to other cells provides us with the solution of how to protect our immune cells. Free radicals, also called pro-oxidants, contain more than one unpaired electron, which is unstable, reactive and potentially damaging. They need to either take another electron from, or donate the unpaired electron to, another molecule species nearby.⁹ Here is what a free radical looks like versus a stable molecule:



Where do free radicals come from? Normal metabolic processes in the human body produce free radicals, which can attack a variety of things, such as starches, fats, proteins and even DNA.^{9, 10}

You may be wondering, if free radicals are formed during normal physiological processes, then how can they be potentially damaging to our cells at the same time? That is because free radicals are naturally balanced out with antioxidants.^{9, 10}

An antioxidant is a molecule stable enough to donate an electron to a rampaging free radical and neutralize it, thus making it impossible for the free radical to cause further damage. This is especially important during a chain reaction, where the free radicals are at their most damaging.

A chain reaction is like a game of dominoes. This is what happens: the first free radical takes an electron from another molecule, which destabilizes the molecule and turns it into a free radical. This molecule does the exact same thing

and takes an electron from another molecule, which also destabilizes it and turns it into a free radical. How does that compare to dominoes?

The free radical that initiates the chain reaction is like the first domino block that sets in motion a cascade of domino blocks falling over. If this domino effect rages on, it will cause a lot of instability, and it will lead to severe damage of a cell.

Some antioxidants are unique because they can actively scavenge free radicals, neutralizing them and the chain reactions that they cause.⁹ An antioxidant is a heavy, big-brother-type domino block, which won't give way to the incoming cascade of falling blocks. It stands tall, ensuring the safety of the smaller blocks behind it. Not all antioxidants wait until damage is done. Some seek to prevent such destruction from happening in the first place.¹¹

In this scenario, a free radical is like a group of young and playful kids who visit the museum on a school trip. The accompanying teachers are the antioxidants who prevent the students from causing trouble or damage to the precious artifacts displayed.

Where do antioxidants come from?

Although some antioxidants are generated during normal metabolism, our body is unable to produce various other antioxidants, which have to be supplied through food.⁹

The Issues of Modern Society

Problems arise when free radicals outnumber antioxidants. In some cases, we are the cause of the imbalance, but other times it is out of our control. Either scenario creates an unfavorable balance between the two. This imbalance is also called oxidative stress.^{9, 12}

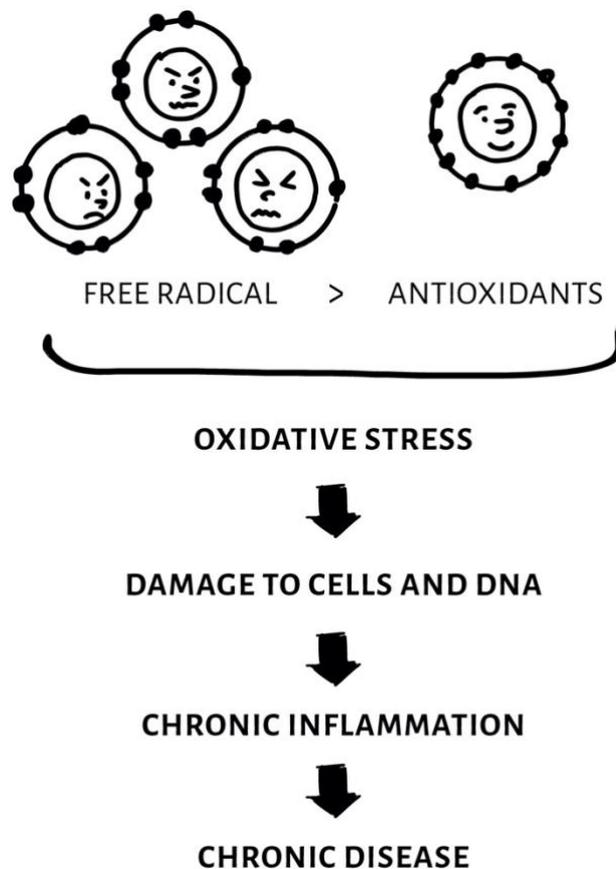
If a free radical is a hacker, an antioxidant would be a good digital security system. What would happen if there were no security systems in place? Imagine our favorite websites having no security against hackers. The result would be internet chaos. What internet chaos is for us, oxidative stress is to our bodies.

Oxidative stress is an important term to remember because it impairs both our health and immune health. The consequences of oxidative stress become eminent when we see what role it plays in the development of disease in general.

A large amount of studies demonstrate that oxidative stress plays a role in:¹²

- progression of cancer;
- cardiovascular disease;
- neurological disease e.g., Parkinson's, Alzheimer's, ALS (Amyotrophic Lateral Sclerosis), MS (Multiple Sclerosis), depression;
- respiratory disease e.g., asthma, COPD (Chronic Obstructive Pulmonary Disease); and
- rheumatoid arthritis.

Oxidative stress also leads to chronic inflammation, which by itself is a cause for chronic disease, like the ones just mentioned.^{13, 14} For this reason, oxidative stress is thought to contribute significantly to all inflammatory conditions.



On top of all that, oxidative stress can hurt our immune cells.⁹ In fact, our immune system is particularly vulnerable to oxidative stress, because the cell membranes of our immune cells are mainly composed of fatty acids, which are an easy target for an excess of free radicals.⁴

We are, largely, ourselves responsible for oxidative stress, ensuing inflammation and impaired immune cells. Although it is sometimes out of our control, even then we still have the power to minimize the damage. What makes us more prone to the development of oxidative stress?

There are three factors involved:

1. Environmental
2. Lifestyle
3. Dietary

Environmental factors

Of all factors involved, environmental ones are those over which we have least control. Unfortunately, we live in an environment where the presence of pollutants in the soil and air is fairly common. These particles either consist of free radicals themselves, overloading our body directly; or they can initiate a free radical reaction within our bodies when they are degraded or metabolized, and free radicals are generated as byproducts.^{12,15} If you remember, these reactions can cause severe damage to our cells through a domino-like cascade.

Furthermore, we can be exposed to more free radicals through X-rays, radiation, ozone, certain drugs and medications, pesticides in, or on, our food, and industrial solvents in personal care products and pharmaceuticals.^{9, 10} Ozone occurs naturally, but is also released during various industrial processes.¹⁶ Although we don't have control over all these factors, it pays to be mindful of, for example, the quality of our food (organic or non-organic) and the things we put on our skin. Personal care products with minimal ingredients and without industrial solvents are

increasingly available, allowing us to reduce free radical intake and free radical production.

Lifestyle factors

Cigarette smoke contains various free radicals, and alcohol promotes our bodies to generate free radicals.^{17, 18} Stress also generates free radicals and, as such, contributes to oxidative stress. Things like prolonged working hours, intense workload, fatigue, lack of sleep, and psychological trauma may contribute to the amount of stress we experience, but they all contribute to an increase of oxidative stress as well, because of an excess of free radicals.¹⁹

Dietary factors

The available research strongly supports that a Western-style diet, high in refined carbohydrates and animal products, leads to the production of more free radicals and oxidative stress.^{20, 21}

In addition, these diets lack the antioxidants to compensate for the increase in free radicals. It is analogous to going out with a pair of uncomfortable shoes that are bound to give you blisters without taking along any Band-Aids. Ideally, we should walk around in comfortable shoes without the need for Band-Aids, which is brought to light further in this chapter.

Out of all the factors above, dietary factors may have the most impact. Why? The typical Western diet leads to a relatively high proportion of free radicals within our bodies and, regrettably, doesn't provide countermeasures to deal with that increase of free radicals. Remember, oxidative stress is an imbalance of free radicals in comparison to antioxidants.

A Western diet is high in refined and junk food, which contain meager amounts of antioxidants. It also generally contains relatively high amounts of animal products, which are also low in antioxidants.²² Does that mean we can't eat any more sweetened cereals, candy, chocolate bars, cookies, hamburgers, and egg and

cheese sandwiches? Or, have a milkshake, soda or any other drink with lots of added sugar? Not necessarily, but that requires us to look a bit deeper into antioxidants.

Bottom line: If free radicals dominate at the expense of antioxidants (oxidative stress), they lead to an impairment of our immune cells in the short term and increase our risk for disease in the long term. Environment, lifestyle and diet are all responsible, but we have the power to turn the situation in our favor.

2.3 The Antioxidant Solution

We have no control over the number of free radicals that enter our body and cause damage. Yet, at the same time, we have a tremendous control over the number of free radicals entering our body.

How so?

We have no control over the polluted air we breathe, and we may have little control over pesticide residues on our food or other chemicals entering our body on a daily basis. But we do have control over the kinds of food we put in our mouths. Antioxidant-rich foods can counterbalance the excess of these incoming free radicals. Do we need only to consume antioxidant-rich foods, forever leaving behind our favorite low-antioxidant treats? Thankfully, it doesn't require an all-or-nothing approach. It does require the magical touch of antioxidants, though, in the right amounts.

Antioxidants make up our first line of defense. We could compare this to a martial arts competitor who is at the lower end of his weight class. He can't move down a weight class because he is already competing in the lowest weight class. Right now, he is at a disadvantage because most of his competitors are stronger than him, thanks to them having more muscle mass. In order to be competitive, he needs to build more muscle and strength. He starts a new workout routine where his

focus is on building muscle. To build muscle, it is necessary to progressively increase the intensity of exercises, while consuming extra calories and nutrition to fuel the muscles and allow them to grow.

If the athlete doesn't increase his calories and add in the much-needed nutrition, he cannot grow in size and strength. Instead, because of the increased intensity, he will lose weight, get weaker and potentially harm his career. The antioxidants are analogous to the much-needed extra energy and nutrition the athlete requires to grow in size and strength, whereas the free radicals represent his training. Any unwanted weight loss is the imbalance of excessive training without proper caloric compensation. This can be compared to oxidative stress, where an increasing number of free radicals is not compensated for by antioxidants. Weight loss hurts the athlete's career, similar to oxidative stress hurting our immune system. The heavier his training, the more energy and nutrition he requires. This is similar to us requiring more antioxidants the more we are exposed to free radicals. If we don't compensate for the free radicals, the resulting oxidative stress harms our health and immune system.

Therefore, in the context of increasing our protection during endemics and pandemics against viruses such as SARS-CoV-2, we need to highlight one thing in particular:

Our immune system is especially sensitive to oxidative stress.

When a free radical attacks the immune cell's membrane, the immune cell becomes impaired, unless an antioxidant intervenes and protects it.⁴

For these reasons, we require adequate amounts of neutralizing antioxidants to protect our immune cells against oxidative stress and subsequent damage, which could otherwise lead to their demise. Insufficient intake and status of dietary antioxidants may suppress immune function to such an extent that it could not only increase our risk of contracting a virus infection, but also increase our risk of possible complications once we get infected.⁴ COVID-19 without complications may feel like a

cold or a flu. However, the complications that do set in, albeit in a small number of people, may prove deadly.

We need antioxidants to protect ourselves against free radicals, but conflictingly, we need free radicals to stay out of harm's way as well. And that is precisely why antioxidants are paramount.

The surprising reason we need free radicals is the fact that many of our immune cells *need to produce free radicals*. Why on earth would an immune cell do that?

As mentioned earlier, a hacker isn't necessarily bad. A company can hire a hacker to implement a state-of-the-art security system offering protection from other online invaders. These free radicals, produced by immune cells, are actually beneficial in battling viruses and pathogens, but again, they need to be balanced out by the neutralizing activity of antioxidant molecules preventing excessive damage. The service that the hacker provides for the company also needs to be balanced out to prevent any complications. The hacker receives a generous salary, and complications are thus avoided. Take the salary or antioxidants out of the equation, and complications are bound to arise.

It therefore makes sense that immune cells need to rely more on antioxidants than any other cell in our body.⁴

An optimal antioxidant status has more benefits. If we contract a respiratory viral infection, the sufficiency of our antioxidant status may play an even more substantial role. That's because respiratory viral infections have the potential to disturb our antioxidant defense. Scientists believe that this is also the case for the COVID-19 infection.²⁰ This means that the presence of sufficient antioxidants becomes a more important factor.

Imagine driving along a mountainous jungle road. Unknowingly, you entered a drug cartel's territory. Suddenly, some of its members, armed to the teeth, jump out on the road in front of you. In a desperate attempt to escape, you step on the gas to flee the scene as quickly as possible. The armed cartel affiliates are forced to jump

out of the way but open fire as you pass by. A bullet penetrates your gas tank and gasoline starts slowly leaking out. Now the question becomes: “What kind of gas tank would you prefer to have, a full one or an empty one?”

To avoid being captured and possibly executed, you would undoubtedly choose a full gas tank to help you escape to safety. The gas tank in this example represents your antioxidant status. The cartel members represent the virus infection, or COVID-19, which disturbs your antioxidant defense. The emptier your gas tank is, the higher the risk that some unwanted complications will occur. The same goes for viral infections. The lower your antioxidant status, the higher the risk for complications, especially if your immune system is already impaired due to age or other underlying health conditions. That’s one reason why members of the same household, contracting the same virus, can experience different levels of intensity and recovery rates: the content of their gas tanks is different.

Hence, it is not surprising that oxidative stress and chronic inflammation, indicating a relative lack of antioxidants, greatly impact the progression of COVID-19 for the worse.²³

An inflammatory response is not necessarily bad. In fact, it is a normal reaction of our immune system. It is not only normal, but even essential to get rid of an infection and to initiate the healing process. However, in this case we are talking about a short-term inflammation, otherwise known as acute inflammation.^{13, 14} Chronic inflammation is the low-grade inflammation that can occur as a long-lasting imbalance of free radicals and antioxidants.

There is something else that happens during a COVID-19 infection that results in complications. Immune cells, and some non-immune cells, can also produce something called cytokines, which contrastingly can be both lifesaving and life-threatening.^{24, 25} Cytokines have gained more attention lately because they have played a significant part in causing pneumonia, ARDS (acute respiratory distress syndrome) and even organ failure in the critically-ill patients affected by COVID-19.²⁵ Here is where the dangers lurk of a dysfunctional immune system.

An overproduction of cytokines is an overreaction of our immune system, better known as a “cytokine storm.” It is an aggressive pro-inflammatory response coupled with an insufficient anti-inflammatory response.²⁶ It is the most common cause of death as a result of a COVID-19 infection. What happens?

Our immune cells cannot locate the virus accurately because they are not recognizing it, forcing them to attack indiscriminately and creating a lot of damage in the process by the production of massive amounts of cytokines. The cytokine storm may ironically still not be enough to kill the virus. It’s like soldiers shooting in the dark, hoping their bullets will find the enemy. Instead, their bullets regrettably find innocent bystanders. Similarly, the cytokine storm causes damage to healthy lung cells, affecting lung function and hence breathing difficulties.²⁷ It’s not uncommon for multiple organs to be affected, leading to organ failure.

The SARS-CoV-2 virus possibly creates this situation, at least partially, by first impairing our immune system before inducing a hyperactivation.²⁸ If the immune system is first impaired, it then makes sense that immune cells have trouble locating the exact position of the virus. And the cytokine storm that follows is a logical sequence stemming from a hyperactive immune system.

This happens only to a very small minority of patients, but we can greatly learn from this and ensure our antioxidant status is sufficient. How?

A steady intake of antioxidants throughout the day allows our immune cells to keep oxidative stress at bay by creating a balance between free radicals and antioxidants. Wonderfully, some antioxidants may even provide extra support in a cytokine storm, as explained shortly.

Sufficient antioxidants and a sufficient antioxidant status are to our immune system what echolocation is to a bat. Without echolocation, where the bat uses waves and echoes to “see,” it is practically blind and will surely cause damage to itself; it will fly against objects and it won’t be able to catch prey and feed. Similarly, a healthy antioxidant status is like a pair of night-vision goggles for a soldier who finds himself in hostile territory in the middle of the night.

Although the cytokine storm happens during an infection, chronic inflammation also plays a role in the production of cytokines. Whenever and wherever low-grade or chronic inflammation is present, specific immune cells that produce these inflammatory cytokines and other similar compounds can cause tissue damage, regardless of whether there is an active (viral) threat present.²¹

To put it in a nutshell: if we suffer from chronic inflammation, our immune system is out of balance and, instead of protecting us, it harms us.

Source of Antioxidants

Vitamins and minerals are of great importance to our immune system. One of the reasons vitamins and minerals can attribute to good immune function is because some of them can act as antioxidants as well.²⁹ However, vitamins and minerals provide only a minor portion of the available antioxidants out there. Comparing vitamins and minerals as part of the total number of antioxidants found in food would be comparable to a single drop taken from a glass of water. Nevertheless, vitamins and minerals perform essential functions, as explained in Chapter 8 of *“Immunity Hi, Virus Bye-Bye.”*

Most antioxidants found in our diet come from compounds other than vitamins and minerals, namely from polyphenols, carotenoids and other phytochemicals.^{22, 30} The term “phytochemical” indicates a compound derived from plants, since *phyto* is the Latin word for plant. That means most antioxidant-rich foods are plant foods. Mind you, plant foods that have been refined have been partly or even completely stripped of their antioxidants, as is covered in the next section.

A carotenoid everybody knows is the beta-carotene which gives carrots, sweet potatoes, pumpkins, etc. their orange color. Another carotenoid, lycopene, gives tomatoes and watermelon their red color. Anthocyanin is a polyphenol that gives blueberries, purple sweet potatoes and pink/purple grapes their respective colors.³⁰

There are about forty different carotenoids present in our diet, as long as we eat a variety of carotenoid-rich foods. Polyphenols is a much more complex group of compounds with lots of subclasses, such as phenolic acids, flavonoids, anthocyanins and lignans. In total, we can find more than 10,000 phytochemicals in this broad group of polyphenols.³¹

Antioxidants are crucial for our health and our immune system, yet they have a dark side as well, under certain circumstances.

Supplementing with specific antioxidants may not be a good idea, because they can disrupt the balance between antioxidants and free radicals by acting as pro-oxidants when taken in high doses, adding to the already exceeding load of free radicals.³² A clear example of this can be found among smokers and people who come into regular contact with asbestos. Both of these groups of people have an increased risk of cancer, but when we start supplementing them with high doses of beta-carotene, the risk of cancer among both groups increases even further.³² Compounds within plant foods are considered safer and healthier than isolated, high doses, such as present in supplements. The two main reasons for that are:

1. **The amount of antioxidants in foods is generally much lower.**

Dietary antioxidants (antioxidants naturally present in food) are abundant in foods from the plant kingdom, but the total amount of antioxidants is substantially lower compared to isolated supplements, which limits their pro-oxidant effects. Therefore, they instead lower oxidative stress and inflammation,^{32, 33} hence the reason health benefits have been mainly observed when antioxidants were consumed within their natural whole food form.³²

2. **Additive, synergistic actions and interactions between phytochemicals.**^{32, 34}

The synergistic actions between phytonutrients in food can be compared to all the individuals of the two teams that take part in a

football (soccer) match. The action of a single player influences the action of other players. When one player moves forward with the ball, all teammates will react by changing their position depending on where the ball is going. The players in the opposing team will also react and change their position accordingly. Pelé is considered to be one of the greatest legends in the history of the sport. Although the importance of a single player cannot be denied, imagine the result of a match where Pelé would have been the only player on the field representing his team. It would have been disastrous. It's called a team sport for a reason. What the players are for a team, the phytonutrients are for a whole, unrefined food, such as whole grain or fruit. The marvel of this harmonious synergy cannot be replicated by supplements.^{32, 34}

Several kinds of antioxidants, such as polyphenols, have the remarkable ability to modulate the earlier mentioned pro-inflammatory cytokines that are responsible for the complications of COVID-19 patients. We can find these polyphenols in a variety of whole plant foods, such as fruits and vegetables, where they contribute to their color, flavor, and pharmacological activities.³⁵

A dilemma exists for some people. That's because they have a compromised antioxidant status. As we get older, our antioxidants' defenses are imperiled so much that it leads to an excess of free radicals, leading to more oxidative stress.^{36, 37} There are some signs that general physical weakness or frailty in elderly people is linked to a lower antioxidant status and higher levels of free radicals.³⁷ Put differently, as we get older, the role antioxidants play becomes even more critical to slow down the oxidative stress, which impacts not only the way our immune system operates, but also the development of many chronic diseases.³⁶

The good news is that age is not the be-all and end-all.

Marilyn is seventy-five years old. She felt she was getting up there in age, as had become clear to her over the last five years. Walking, cycling and everyday activities just didn't go so smoothly anymore. As a matter of fact, she noticed more aches and pains all over her body. Recently, her family physician retired and she registered with another nearby physician, Dr. Bernards. During her first checkup, Dr. Bernards asked Marilyn some questions about her diet. Marilyn was kind of surprised, because her previous doctor never really asked about her diet. Marilyn told Dr. Bernards she would have some white toast with cheese for breakfast. Some potatoes, meat and a small portion of vegetables would be her lunch, and she'd eat fried white rice or white pasta for dinner, with a bit chicken or fish and a few vegetables.

Dr. Bernards is not an ordinary doctor. He specializes in lifestyle medicine, meaning he emphasizes the importance of his patients' diet and lifestyle. Dr. Bernards had followed the same studies as his colleagues, but after he opened his doctor's practice, he felt inadequate in some ways. So many illnesses of his patients were preventable and reversible, yet he couldn't help resolve many of their issues. It motivated him to brush up on his knowledge of nutrition, which he felt was severely lacking due to the negligible nutrition content offered during his studies. Dr. Bernards started looking into the effects of nutrition and lifestyle on the leading causes of death and illness. Over the course of several years, Dr. Bernards started implementing all the knowledge he had acquired, so much so that he started noticing better results among his patients. He noticed that, whenever his patients incorporated his advice, it made a significant difference in their quality of life.

Dr. Bernards felt that there was significant room for Marilyn to improve her quality of life. On the advice of Dr. Bernards, Marilyn started slowly incorporating some more antioxidant-rich foods in the form of

whole plant foods. At first, she started by adding in some more fruit and expanded on that by increasing her vegetable consumption and swapping some refined grains for whole grains. Four months after her first consultation with Dr. Bernards, Marilyn was consuming a significant portion of antioxidants every single meal, and she started being more active as well. Marilyn did not anticipate the changes she experienced: she felt fewer aches and pains, was more joyous and generally became a much healthier person. She even surprised her own daughter, who has gotten sick more often than her mom this year.

Marilyn's situation is a good example that age doesn't have to be an obstacle on our road to good health. Paying extra attention to antioxidant-rich food is like wearing an extra layer of clothes in winter. It provides the much-needed warmth during colder times.

Bottom line: We are surrounded by free radicals. They are not inherently evil, but they need to be counterbalanced by antioxidants to prevent them from creating havoc and unnecessary damage. Whole plant foods provide all the antioxidants we need. They are superior to supplements, which can't replicate the innumerable nutrients these foods contain.

2.4 The Best Sources of Antioxidants

Junk food that contains an abundance of antioxidants: is that even possible? Maybe it is. Refined and highly processed plant foods are not a good antioxidant source, but there is one exception. This refined and processed food is called junk food by some and a healthy treat by others. We are talking about chocolate. How does it rank on the antioxidant score?

In the biggest study to date, researchers tested more than 3,000 different foods and ranked chocolate among the top antioxidant foods.²² For the chocolate lovers among us, that seems like good news, but there's a catch: dark chocolate is vastly superior to white or milk chocolate. What's the deal with chocolate, and why does it score so highly? It's actually the cacao content of the chocolate, not the chocolate itself. And, it contains no added fat and no added sugar. A higher antioxidant option, therefore, is cacao beans, cacao nibs or cacao powder, which gives chocolate its distinct flavor. It can be used to make chocolate shakes, desserts and other chocolate treats.

What about the other foods?

Spices and herbs pack the biggest antioxidant punch. That's a good thing, because that means a little bit is enough. Imagine eating spoonfuls of turmeric, cinnamon or clove powder daily. We don't have to go overboard. Other foods with high levels of antioxidants include vegetables (green leafy vegetables in particular), fruits, nuts, seeds, berries and chocolate, followed by (in random order) tubers, whole grains, legumes and mushrooms.

What about the highest antioxidant drinks?

Tea, herbal tea, flower tea and coffee ranked the highest. What further stands out is that whole foods are superior to their refined counterparts. That means brown rice beats white rice, and whole wheat flour beats "regular" white flour. Fruit beats fruit juice and other sugary drinks.

The difference between refined grains and whole grains is easy to understand when we compare it to the clothes we wear.

Imagine you want to visit somewhere. It can be any place. A place that stimulates your artistic side, such as a gallery. A place that can benefit your career, such as a networking event. A place you visit for entertainment purposes, such as a cinema or a club. A place where you can enjoy time together with your date, such as a restaurant.

Whether your goal for visiting these places is related to your career, education, entertainment or something else, you can only achieve your goal under the following circumstances: you have to wear clothes. Clothes are the key to unlock the door, behind which are located the benefits you are seeking to reap. This layer of clothes is beneficial, just as the layer covering grains is beneficial; it contains fiber, vitamins, minerals and much-needed antioxidants.

Imagine going to any of your chosen events without that precious layer of clothes. You will be denied access, failing to gain any benefit. Worse than that, you will be taken into custody, where you will be confined to an inhospitable environment. In conclusion, you end up causing harm to yourself. The removal of the outer layer of grains leads to the creation of refined grains. Examples of refined grains are white bread and white rice. Refined grains offer no benefits and cause harm as well. They lack nutrients, and refined grain intake is associated with higher levels of inflammation.³⁸ Inflammation, as mentioned before, can lead to various chronic diseases and can also exacerbate oxidative stress, which leads to more free radical formation, which in turn leads to the disruption of our immune cells.

Bottom line: Whole plant foods (unrefined) contain the best bang for your antioxidant buck. The less refined a food is, the more antioxidants it contains.

Here is a checklist of the top antioxidant foods:

Herbs and spices

Vegetables

Special mention: green leafy vegetables

Fruit

Special mention: berries

Nuts and seeds

Special mention: English walnuts

- Dark chocolate

Special note: cacao beans, nibs or powder provide the antioxidants

- Tubers

Special mention: sweet potato

- Whole grains

- Legumes

- Mushrooms

Checklist of antioxidant-rich drinks:

- Tea

- Herbal tea and flower tea

- Coffee

Special mention: robusta and light roast arabica

See the Appendix for practical examples regarding the antioxidant content of different foods.

Furthermore, if you want to know more about phytochemicals and antioxidants, see some of the books I recommend on well-thy-health.net/recommended.

2.5 Essential Fatty Acids

Fat is an important constituent of our immune cells, yet the irony is that too much fat may tamper with a proper immune response. Startlingly, the average fat intake may even be too high. However, not all fats are created equal. We distinguish between essential fatty acids and non-essential fatty acids. Immune cells show an

abnormal content of polyunsaturated fatty acids (PUFA) in comparison with other cells.⁴

PUFAs are the essential fatty acids, omega-3 and omega-6, which are found in nuts, seeds, avocado, grains, legumes, vegetables, meat, dairy products, fish, eggs, oils and oil-based products. Both of these fats are essential, but the issue widely prevalent in Western diets is the imbalance that occurs between the two types of fatty acids. The typical Western diet is characterized not only by an overconsumption of refined sugars, salt and saturated fat, but also an overconsumption of omega-6 and an *underconsumption* of omega-3.³⁹

Although omega-6 is easily found in multiple sources, the most common sources in the average Western diet are oils, followed by animal fat and grains.⁴⁰ Omega-3, on the other hand, is not as prevalent and is mostly found in fish and other marine life; in specific seeds like flax, chia and hemp; in nuts like walnuts; and in lower amounts in green leafy vegetables.

Why is the balance between omega-3 and omega-6 so important?

Omega-6 is an essential fatty acid, and it is a vital component of our immune cells,⁴¹ yet omega-6 easily causes problems.

Although essential, omega-6 has more pro-inflammatory properties and omega-3 has more anti-inflammatory properties.⁴² As mentioned before, inflammation per se is not a terrible thing, just like a free radical isn't. In fact, when we get an infection, inflammation will actually save our lives. The conundrum lies within the inflammatory pattern of the Western diet. Since it is already inflammatory to begin with, the last thing we need is more inflammatory components. Instead of throwing water on the fire that is inflammation, we throw petrol on it, exacerbating the inflammation instead.

The importance of omega-3 for immune cells becomes clear because they are favored by our immune cells. More precisely, omega-3 gets prioritized by the immune cells and gets incorporated into the cell membranes of the most common immune cells, neutrophils, at the expense of omega-6.⁴² Furthermore, what stands

out is that a favorable ratio of omega-3 to omega-6 can improve the special virus-eliminating skill which the immune cells possess. Scientists describe this fascinating ability as phagocytic activity.^{41, 42} These immune cells have the ability to completely engulf a virus and inactivate it. In more simple terms, we could compare it to the classic game of Pac-Man, where Pac-Man makes his way through a maze, engulfing all the dots that lay before him. Unlike the game, which only contains a single Pac-Man, our immune system has access to an army of Pac-Men.

With higher ratios of omega-6, our immune cells' phagocytic Pac-Man skill will be weakened. However, omega-6 is not the only contributor. Increased saturated fat has a similar effect, in particular the saturated fat found in palm oil, meat and dairy products.^{43, 44}

Remember, omega-6 itself is not the problem – it is the excess of omega-6 and the shortage of omega-3. Our diets normally contain liberal amounts of omega-6, whereas they are generally low in omega-3. We don't have to worry about an excess of omega-3, unless we only consume fatty fish or flaxseeds and remove all other sources of fat, which doesn't seem too realistic.

Read further to discover what quantities to aim for.

Interestingly, the ratio of these essential fatty acids may be only one part of the puzzle. The total amount of fat may also play a role. Despite fat being such a vital component of immune cells, scientists conducting studies where they reduced the total fat intake seemed to show improved activity and proliferation rates of white blood cells. How did they accomplish this? By implementing a fat reduction of five to fifteen percent of the total energy intake.³⁹ In more concrete terms, that translates into a reduction of one to three tablespoons of oil.

A reduction of fat may help our immune system, but yet again, ironically, it may also have opposite effects if the circumstances aren't right. If it is combined with daily fish consumption (120g to 188g), it may actually suppress our immune system.⁴⁵ In one study, they had two groups with a reduced fat intake. One group was eating fish daily, whereas the other group ate plant sources of omega-3. Only

the fish group showed immune suppression. These results are not consistent with the results from some other studies. However, other studies were usually shorter in duration, whereas this particular one lasted for six months. Granted, this study was only conducted on elderly people, but it is risky nonetheless to eat fish daily: not merely due to the potential risk of immunosuppression, but also because fish is notorious for being contaminated with heavy metals and other environmental contaminants.^{46, 47} Fish oil supplements encounter the same problem.⁴⁸

Fish contains omega-3 in the form of DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid), which are essential fatty acids. DHA and EPA are not found in plant sources (except for seaweed). For this reason, the WHO (World Health Organization) recommends to consume one to two servings of fish per week, despite contamination issues, because they believe the benefits outweigh the risks. The WHO also states that people who are not consuming fish should ensure adequate intake of plant sources of omega-3 called ALA (alpha-linolenic acid).⁴⁹

Although this may sound confusing, it's thankfully not too complicated. There are three kinds of omega-3, and they are all essential: ALA, DHA and EPA. Plant sources contain mostly ALA, and marine sources (animals, plants and algae) contain all three. Thankfully, ALA can be converted to DHA and EPA. However, due to a low conversion rate, the amount of ALA in the diet needs to be higher to get an adequate amount of DHA and EPA. Although not set in stone, 250mg of DHA/EPA is a common recommendation for the average person. Scientists estimate that one needs 2.2–4.4g of ALA daily if there is no preformed DHA and EPA in the diet.⁵⁰ This translates into one and a half to three tablespoons of flaxseeds or chia seeds. The conversion rate improves if the diet doesn't contain excessive amounts of omega-6 and if no DHA or EPA is present in the diet.

Oils are a problem. High omega-6 oils such as sunflower oil, corn oil, peanut oil, soy oil, safflower oil and, to a lesser extent, olive oil can easily disturb the omega-3 to omega-6 ratio. These are not the only downsides of oil. Oils are the most caloric refined food on the planet. One single tablespoon of oil provides more than 100

calories. This is approximately five percent of the daily calories needed for many adults.

Next, Monique shows what happens when you reduce your oil intake.

Monique set two goals earlier this year. She kept hearing about the importance of essential fatty acids, omega-3 in particular. Monique analyzed her diet and came to the conclusion that her intake of omega-3 was very low. One goal she had was to consume more healthy fats, so she wanted to increase the amount of omega-3. The second goal was to lose a few pounds, ten to be precise. Monique didn't like to eat seafood of any kind. As a matter of fact, the smell of anything that came out of a sea or river disgusted her. So, seafood was definitely out of the question. She looked for other options. The other day she came across some organic eggs in the supermarket that contained DHA and EPA. She read that dietary guidelines suggested consuming at least 250mg of DHA and EPA daily. One egg contained 340mg of ALA and 100mg of DHA. That meant one egg wasn't enough. Monique wasn't willing to eat more eggs than that because she didn't want to add more saturated fat and cholesterol to her diet. Especially since saturated fat has the most pro-inflammatory properties of all the fats.^{39, 51}

She heard grass-fed beef has more essential fatty acids, but upon inspection it had negligible amounts of DHA and EPA and only a small amount of ALA.⁵² Instead, she decided to add the richest source of ALA there is to her diet: flaxseeds. She chose flaxseeds for a few reasons. The first reason was that flaxseeds contain the most ALA. The other reasons were that flaxseeds are antioxidant rich and have been shown to be protective against breast cancer, which runs in her family.⁵³ She calculated that she would need about one and half to two tablespoons of ground flaxseeds a day. She opted for ground flaxseeds, because it

improves the ALA bioavailability. In order to improve the bioavailability further, she wanted to reduce the amount of oil in her diet. On average, she used three tablespoons of oil daily. She decided she would cut the amount of oil in half, which would reduce her calorie intake by more than 150kcal, right in line with her desire to lose weight. Monique had oatmeal for breakfast in the morning, to which she added one tablespoon of ground flaxseeds the first week, and a total of two tablespoons the second week to let her body get adjusted to the extra fiber. Monique loved the addition of flaxseeds and she really enjoyed her breakfast. Over the following weeks, she found that it was not that difficult to cook with less oil. Sometimes she would try and water-fry her food. She would use just enough water to prevent her food from sticking to the pan and burning. Over the course of three months, Monique had decreased her oil intake slightly more than initially planned. She would use one tablespoon of oil on average daily. This meant that every day she cut more than 200 kcal. The added bulk of the flaxseeds made Monique feel fuller, and she didn't feel the need to snack on anything during the morning. Now, five months later, Monique feels good. To her great surprise, she has already managed to lose eight pounds. And the best part, she didn't even "go on a diet."

Oil consumption can easily enable us to consume too much omega-6 at the expense of omega-3. Not only that, oil contains little to no nutrients. Whole food forms are not only lower in calories, but also contain more nutrients and antioxidants. They are more satiating, preventing us from overconsuming calories. Therefore, they are the most optimal food.

As we saw from Monique's example, she prioritized food over supplements. If she hadn't done that, what options would she have had? Many in Monique's situation prefer to take a fish oil supplement in order to obtain the essential fatty acids, DHA

and EPA. As mentioned earlier, fish oil supplements have the problem of being contaminated with environmental pollutants. The good news is that it is possible to get DHA and EPA directly and simultaneously avoid ingesting pollutants that accumulate in our bodies over time. The pollutant-free option is algae oil.⁵⁴ Algae is what fish feed on and it builds up their stores of DHA and EPA. It is the safest source of DHA and EPA.

Bottom line: Both the immune cell and its membrane are made up of fatty acids. These fatty acids are vulnerable to free radicals, which can damage the precious membrane of the immune cell, which in turn is a vital component of a complex communication network within our immune system. An optimal immune system consists of healthy immune cells. Because of their vulnerability, they require essential fatty acids and a constant supply of antioxidants. All of these can be obtained through our diet. Essential fatty acids can be supplied through marine sources, DHA/EPA-rich eggs or DHA/EPA-enriched foods and specific nuts and seeds, whereas the vast majority of antioxidants come from non-refined, whole plant foods.

Thank you for reading *The Secret to Healthy Immune Cells*. If you've enjoyed it, please consider writing a brief review on Amazon or Goodreads. Your feedback is important to me, because you can help other readers decide whether they'd like to read my book as well.

Finally, if you want to learn more about how to optimize your immune system, check out my more extensive book on immune health, *Immunity Hi, Virus Bye-Bye*. It offers more in-depth strategies regarding diet, and it covers lifestyle and supplements, in detail, on top of that. Available from November 2020 on Amazon.

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APPENDIX

Antioxidant List

Diet is a complex topic. The typical diet contains more than 25,000 food components that our bodies can utilize in one way or another. Antioxidants—comprising thousands of these compounds—partly explain the protective effect of plant foods.

As mentioned in earlier chapters, it's widely accepted that a plant-based diet with a high intake of fruits, vegetables, and other nutrient-rich plant foods can reduce the risk of oxidative stress-related diseases.^{1, 2}

The antioxidant list, to which is referred in this section of the book, is publicly available and thus free of charge. It is the product of a collaboration of scientists who deserve all credit,² as explained at the end of this Appendix.

The study, from which the antioxidant list originates, is actually targeted towards the scientific community, but you can also use it provided that you take a few factors into consideration.

For this reason, I've added the following sections and examples, so that you know how to use it to gain maximum benefit and avoid making misinterpretations.

All tables presented also originate from the aforementioned antioxidant list.

Food Interactions

To ensure you use the antioxidant list correctly, it is necessary to provide some examples. One thing to keep in mind is that different foods can interact with one another. Amazingly, the antioxidant content can actually increase when we combine certain foods. Unfortunately, it's impossible to list all these interactions as research is yet too scarce.

On the other hand, some food combinations can result in a significantly lower antioxidant value. Fortunately, we *are* able to observe this in the antioxidant list.

Example 1

Product	Manufacturer / product label / country of origin	Procured in	Antioxidant content in mmol/100g	Comment
Coffee, Cappuccino, single, prepared	Stockflehts, Norway	Norway	1.04	3
Coffee, Cappuccino, single, prepared	Kaffebrenneriet, Norway	Norway	2.14	3

Our focal point is the fourth column, which lists the antioxidant values. These values are assigned as mmol/100g. Thankfully, we need not to put on our science hat to be able to understand them. They will become clear from the comparisons we're making.

As you can see from previous table, there is a difference between the antioxidant content of the two cappuccinos. How come there is a difference?

Individual differences can occur due to growing conditions, seasonal changes and genetically different cultivars, storage conditions and differences in manufacturing procedures and processing.² Therefore, it's more important to look at the average.

Now, notice the change that's about to occur. A cappuccino is nothing more than an espresso with frothed milk. What happens when you leave out the milk entirely? The antioxidant content rises significantly; up to fifteen times!

Coffee, Espresso, single, prepared	Stockflehts, Norway	Norway	15.83	3
Coffee, Espresso, single, prepared	Kaffebrenneriet, Norway	Norway	12.64	3

This finding is in line with research that found higher amounts of antioxidants in the blood stream of people right after drinking black coffee when compared to drinking milk coffee.³ Milk impairs the bioavailability of some antioxidants and black is actually a better way to drink your coffee.

Whole Foods Versus “Unwhole” foods

As mentioned in Chapter 2, section 4: “The Best Sources of Antioxidants,” there is a distinction to be made between whole grains and refined grains. This is particularly noticeable when we compare their antioxidant values.

Example 2

White rice loses a large chunk of its antioxidants as becomes clear from the table below:

Rice, brown, ecologically grown	Urtekram, Denmark	Norway	0.33	3
Rice, brown, grain, Basmati	Tilda, England	Norway	0.36	3
Rice, brown, grain, Basmati, cooked	Tilda, England	Norway	0.27	3
Rice, grain, fast	Ming	Norway	0.01	3
Rice, grain, Jasmin	Hakon, Norway	Norway	0.02	3
Rice, long grain, white	Store Brand	USA	0.08	6
Rice, long grain, white, cooked	Store Brand	USA	0.02	6

Based on the rice varieties tested here, brown rice has anywhere from 3 to over 30 times more antioxidants than white rice! This disparity can be explained because refined grains have a part of their edible, antioxidant-containing portion removed.

Example 3

Similar examples can be found for rye, which is commonly used in sourdough breads:

Rye, white flour	Regal, Norway	Norway	0.20	3
Rye, wholemeal flour	Regal, Norway	Norway	0.50	3

Example 4

And for wheat (bran, or skin, removed) versus whole wheat:

Wheat bread, toasted	Wonder	USA	0.54	6
Wheat bread, toasted	Store Brand	USA	0.52	6

Whole wheat bread, toasted	Wonder	USA	1.00	6
Whole wheat bread, toasted	Nature's Own	USA	0.93	6

Although not comparable to refined grains—since they are clearly associated with negative health outcomes—there are other foods to which this “whole versus unwhole” food rule also applies, including foods that are considered healthy.

Example 5

Unpeeled apple versus peeled apple:

Apples, Golden Delicious		USA	0.26	6
Apples, Golden Delicious, without peel		USA	0.10	6

As you can see, the peel contains a big chunk of the antioxidants of the apple, showing yet again that whole foods simply contain more nutrients. We can see a similar result for nuts.

Example 6

Nuts with or without their pellicle – the edible skin of nuts and seeds:

Peanuts, Polly, roasted, with salt, without pellicle	KiMs, Norway	Norway	0.62	1, 3
Peanuts, roasted, with pellicle (purchased with shell)	Food Man	Norway	1.97	1, 3
Peanuts, without pellicle		USA	0.35	1, 6

Walnuts, with pellicle (purchased with shell)	India	India	15.76	3
Walnuts, with pellicle (purchased with shell)	Natural	Norway	31.38	3
Walnuts, with pellicle (purchased with shell)		Norway	33.29	3
Walnuts, without pellicle		Norway	1.81	3
Walnuts, without pellicle (purchased with shell and cupule)		Italy	0.46	3
Walnuts, without pellicle (purchased with shell)	Shells	Norway	0.74	3
Walnuts, without pellicle (purchased with shell)		Italy	1.04	3
Walnuts, without pellicle (purchased with shell)		Norway	0.79	3

The difference, for both peanuts and walnuts, is substantial but the antioxidant content of walnuts *with* pellicle is just on another level. Peanuts are technically not a nut, but due to their similar nutrient profile they are often classified as such.

Antioxidant Tunnel Vision

As it has become evident how antioxidant levels can be impacted, focusing *solely* on antioxidant content, however, is not a good strategy.

Let's use ice cream as an example:

Ice cream	Burger King	USA	0.00	6
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Ice cream, from this particular franchise, is not looking too impressive on the antioxidant scale. But this one *is*:

Ice cream, chocolate, regular fat	Breyers	USA	0.76	6
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It contains even more antioxidants than most apples:

Apples, Fuji		USA	0.22	6
Apples, Gala		USA	0.25	6
Apples, Gala	Italy	Norway	0.22	3
Apples, Golden Delicious	New Zealand	Norway	0.15	3
Apples, Golden Delicious		USA	0.26	6
Apples, Golden Delicious, without peel		USA	0.10	6
Apples, Granny Smith		USA	0.54	6
Apples, Granny Smith	Le Crunch	Norway	0.51	3

Does that mean you should eat chocolate ice cream instead of apples?

Why does chocolate ice cream have relatively many antioxidants in the first place?

If you guessed it's because of the cacao, you were right. Sadly, chocolate ice cream also contains an abundance of things that are not in alignment with good (immune) health such as added sugars and (added) saturated fat. The combination of which may sound tempting, but it's also a "recipe" for diabetes, which impairs immunity even further.^{4, 5, 6} Therefore, antioxidants are not something we should excessively cling on to. Similarly, holding hands with your lover may be pleasant, but you should let go occasionally in order to experience something called freedom.

Although the antioxidant list can be useful in the ways we have covered so far, it shouldn't replace our common sense. Whole foods are preferable over refined foods. That means apples are preferable over chocolate ice cream (forgive me).

When High Is Not the Be-All and End-All

Some whole foods that are lower in antioxidants may still be beneficial if their antioxidants are more easily absorbed and utilized (more bioavailable). It's also possible that some active phytochemicals found in plant foods may initiate your body's antioxidant defense mechanisms, but they may be overlooked purely based on their lower antioxidant content. Therefore, it is good to vary the foods you

consume, to maximize the intake of different kinds of nutrients. The same strategy we are often advised to follow when it comes to our intake of vitamins and minerals. Antioxidants are no different.

An example would be to consume different kinds of fruit:

Thomas likes his fruits. He prefers blueberries because they are one of the higher-antioxidant fruits, and they are associated with various health benefits. However, Thomas also knows that all berries are “antioxidant bombs.” For this reason—although he consumes blueberries almost daily—he adds a mixture of berries to his cereal several times a week, just to profit from a wider array of nutrients, including antioxidants. For the same reason, he also mixes up his cereals – oatmeal is his preferred cereal of choice, but Thomas will sometimes opt for puffed buckwheat or barley flakes instead.

Fair Comparisons and Excess

Antioxidants are listed per unit of weight (100 grams). While you would easily be able to consume 100 grams of watermelon without any ill effects, I wouldn't advise you to try and consume that much of, for example, cinnamon – that will prove deadly. Herbs and spices are not meant to be consumed in large quantities. Consuming an excess of any kind of food, for that matter, is not recommended. Focusing on a wider variety of foods is more beneficial, because you're exposed to a wider variety of nutrients, including antioxidants.

Download

The antioxidant list can be found from within the original study: “*The total antioxidant content of more than 3100 foods, beverages, spices, herbs and supplements used worldwide.*” For quick access click [here](#), or follow this link: <https://rdcu.be/b9BXS> and scroll down to find “Additional file 1,” right below the “Conclusion.”

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About the Author



Jorg Wijnen is a dietician, writer and self-proclaimed chef who strives to develop compassion and help others whenever he can.

He specializes in immune health and disease prevention using lifestyle medicine. Jorg has a knack for simplifying complicated science, using stories and analogies to make it more relatable.

Disappointed with the health information available in the global pandemic, he wrote:

- *Immunity Hi, Virus Bye-Bye: Proven Strategies to Optimize Your Immune Health During Pandemic Times;*
- *The Secret to Healthy Immune Cells: The Fatty Antioxidant Solution (free);*
- *COVID-19 Home Remedies and Prevention: Myths & Truths (free).*

The latter can be downloaded (for free) on well-thy-health.net/myths-and-truths.

Jorg makes, arguably, the world's healthiest and yummiest cookies, and meditates, a lot. His wife is overjoyed she married a health and wellness nut, some of the time.

Reach out to Jorg on well-thy-health.net, facebook.com/wellthyhealth or send him an email at info@well-thy-health.net.

Recommended Books

There are several books on the market that explore immune health and the immune system. However, there are many more books that cover the individual aspects that a well-working immune system is composed of.

For example, sleep directly impacts our immune system, but it also affects other components of our health – on both the physical *and* mental level. Exercise, stress and mindfulness practices, are some other examples that can be seen in a similar light.

Although I have covered these, and more, in *Immunity Hi, Virus Bye-Bye*, there are some phenomenal authors who have written about these individual topics in fascinating detail (and in more detail than I have!). I have my own favorites for general health, immune health and more specific health topics. Find my recommendations on well-thy-health.net/recommended. I've written a brief description for each book, so that you can more easily see whether any of them resonate with you.