

EFI's *Master Guide* Series



Guide to
**CHRONIC
INFLAMMATION**

How to Tame the Fires of Chronic Inflammation and
Avoid Today's Most Dangerous Diseases

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Master Guide to Chronic Inflammation

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Your Complete Guide to an Anti-Inflammatory Diet

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Introduction

What Is the Big Deal About Inflammation?

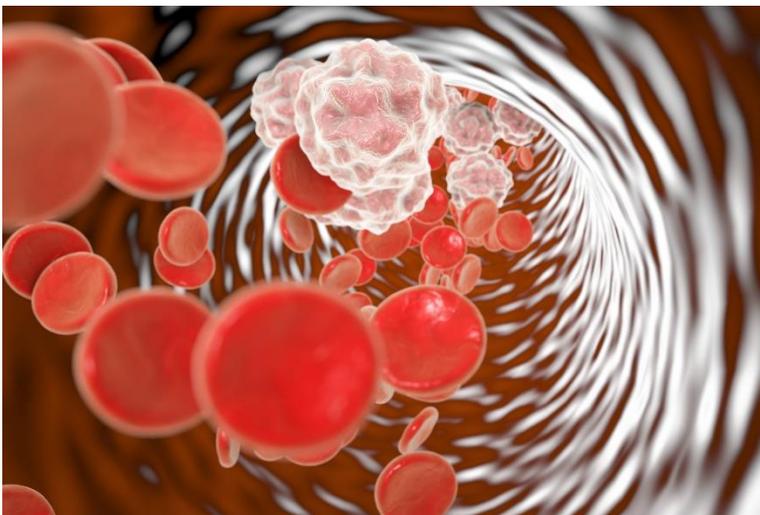
Inflammation. What's the big deal?

It wasn't that long ago that if you spoke about inflammation, you were likely talking about the swelling and redness that appears on a wound as it's trying to heal.

That's one type of inflammation. But over the past couple of decades, we've been hearing a lot about another type of inflammation that can be much more serious and detrimental to your health.

A Brief History of Inflammation

Inflammation has always been with us. According to researchers, the earliest signs of the inflammatory process could be found on the bones of dinosaurs.



Back in the 5th century BC, Hippocrates was said to regard inflammation as an early component of the healing process after injury. A Roman writer named Aulus Celsus living between 30 BC and 45 AD described the four main signs of inflammation as redness, warmth, swelling, and pain.

The invention of the microscope in the 16th century and later improvements to its optical resolution gave rise to the early description of blood circulation and its responses to inflammation. The link

between microbes, infection, and inflammation wasn't made until the nineteenth century.

Then in the 20th century, science made rapid advancements in understanding the nature and underlying causes of inflammation. In recent years, the development of gene-targeted animal models has given researchers better tools for studying inflammation.

All this has led to today, when inflammation may be blamed for playing a key role in several of our most deadly diseases, from heart disease to cancer to type 2 diabetes, and more.

How did we go from inflammation being a healing process to being something we have to worry about?

The Two Sides of Inflammation: Healing and Destructive

Inflammation has been important to survival throughout human history because of its connection to healing. If you cut yourself, the immune system creates inflammation to help rid the area of any invading microorganisms, then builds new skin cells to close the wound. If you develop a bacterial infection, the immune system revs up the inflammatory process to damage and kill the infectious bugs.

Simply put, inflammation helps eliminate the cause of physical injuries, getting rid of dead or damaged tissue, then goes on to repair the body. For centuries, it has been seen as primarily a positive force for health.

It wasn't until the 19th century that researchers began to question this one-size-fits-all view of inflammation. They started to notice that while acute (short-term) inflammation was associated with healing, chronic (long-term) inflammation could do the opposite—hurt our health.



Inflammation is Complicated but Dangerous

The more scientists learn about inflammation, the more they realize they need to learn.

That's because inflammation behaves differently depending on many factors. There are signaling cells in the body communicating with one another that can determine how much inflammation is needed and when. But these signals may get crossed or be mistaken in their messages depending on things like the interplay between genes, environmental or lifestyle factors, and more.

In other words, it's an extremely complicated process.

Scientists continue to study it. Meanwhile, what is clear is that chronic (long-term) inflammation is dangerous, and something we should try to avoid.

The problem is that when inflammation becomes chronic, it morphs from a healing force to a destructive one. It causes tissue damage and scarring (fibrosis), which in turn, stimulate even more inflammation, setting up a vicious cycle of damage that gradually worsens a person's health.

Today, inflammatory diseases are the most significant cause of death in the world, and the prevalence of these diseases is expected to increase over the next 30 years in the U.S. Worldwide, 3 of 5 people die every year due to chronic inflammatory diseases like stroke, chronic respiratory diseases, heart disorders, cancer, obesity, and diabetes.

The Silent Killer

Another reason that chronic inflammation is so dangerous is that it can remain undetectable for a long time.



Whereas acute inflammation—such as the redness and swelling you see associated with a wound—is visible and noticeable because of how it feels, chronic inflammation progresses silently, often with no symptoms. People who have it don’t know they have it.

Most of us believe that if we’re not sick, we’re healthy. That’s not necessarily true, however. You may not feel it yet, but you could have increased levels of chronic inflammation slowly damaging your cells at this very moment.

Chronic inflammation tends to “smolder” at a low level for years. It doesn’t cause pain, but it damages cells and tissues, and that damage accumulates over time. If you have high levels of this type of inflammation going on in your body, you may not notice it, but it could mean that you’re not as healthy as you think.

Chronic inflammation works its havoc in several different ways. It can damage arteries, which after many years, can lead to heart attack and strokes. It may destroy nerve cells in the brain, leading to dementia and Alzheimer’s disease. It can depress the immune system and allow cancerous cells to grow until they form tumors.

This type of silent inflammation lays the groundwork for disease. Worse, it seems to have become an epidemic in America and other Western civilizations.

An Epidemic of Chronic Inflammation

From what scientists are seeing, it seems that cases of chronic inflammation are increasing. One of the main reasons for this is the epidemic of obesity in Western nations.

According to the Centers for Disease Control and Prevention (CDC), the obesity prevalence in the U.S. was 42.4 percent in 2017-2018. That means 42 percent of the population was not just overweight, but obese (described as having a body mass index of 30 or more).

From 1999-2000 through 2017-2018, obesity prevalence increased from 30.5 percent to 42.4 percent. We know that obesity-related conditions include heart disease, stroke, type 2 diabetes, and some types of cancer.

Meanwhile, overweight and obesity are strongly connected to higher levels of chronic inflammation. In a 2021 study, scientists noted that excess body fat contributes to chronic inflammation, and found that the risk of high levels of inflammation increased as BMI increased.

“The obesity epidemic is producing an epidemic of chronic inflammation,” the scientists wrote.

It’s not only our weight that’s driving the change: it’s our lifestyles, too. Scientists

have linked sedentary lifestyles, chronic stress, and unhealthy diets to a greater risk of chronic inflammation. Smoking and excessive alcohol consumption can stoke the fires of inflammation, too.



You Have the Power to Cool Inflammation

The fact that your lifestyle choices can affect levels of inflammation in your body means that you have a lot to say about whether inflammation hurts you or not.

You can’t control *all* of the factors involved. Your genes, for instance, play a role, and you can't change those.

But you can change the foods you eat, how much you move your body each day, and how you manage your stress. You can take steps to manage your weight and keep inflammation levels under control so they don’t create the sort of long-term damage that is associated with so many of today’s major life-threatening diseases.

In this ebook, we want to help you understand more about inflammation, what causes it, and how it is related to diseases like heart disease and cancer. Then we’ll take you through the steps you need to take to safeguard your health.

These include understanding the standard treatments for inflammation, then going beyond those to incorporate inflammation-calming lifestyle habits.

In the end, everything you do to reduce inflammation will be good for your overall health and well-being, so you have nothing to lose.

Let’s get started!

Chapter 1

What Is Inflammation?

To understand how inflammation can turn destructive, we first have to understand exactly what it is. In this chapter, we'll give you an introduction to this fascinating part of the immune system.

Inflammation Is a Tool of the Immune System

The first thing to understand is that inflammation is a tool that the immune system employs when it thinks it needs to. So, what is the immune system?

The body's immune system is a complex network of cells, tissues, organs, and other substances that help the body fight off infections and other diseases, as well as encourage healing after any type of injury. The main parts of the immune system are:



White blood cells

These are the key players in the immune system. They're made in the bone marrow and are part of the lymphatic system. They attack foreign invaders like bacteria, viruses, parasites, and fungi in the body.

White blood cells include lymphocytes like B-cells, T-cells, natural killer cells, and many other types of immune cells.

Antibodies

These are cells that help the body fight off microbes and the toxins (poisons) they produce. They can identify these microbes by their characteristics, such as substances on their surfaces or chemicals they produce. The antibodies mark these microbes for destruction, then call in other cells to help them carry out their attack.

The complement system

This is a system made up of proteins that help the antibodies do their job. It is a component of blood that helps kill bacteria and other invaders. In essence, this system "complements" the work of the antibodies, encouraging a series of inflammatory responses that help to fight off infections.

The lymphatic system

This is a network of tubes throughout the body that performs several tasks:

- Manage fluid levels in the body
- Remove cellular waste
- Absorb fats from the digestive tract and transports them back to the bloodstream
- Produce and release white blood cells and other immune cells to monitor and destroy foreign invaders

Spleen

This is the largest lymphatic organ in the body. It's located on the left side under the ribs and above the stomach. It filters and stores blood and produces white blood cells that fight infection.

Thymus

This organ is located in the upper chest beneath the breast bone. It matures a specific type of white blood cell that fights off invaders.

Bone marrow

This is the soft, spongy tissue in the center of certain bones, like the hipbone and breastbone. It produces white and red blood cells.

All of these parts of the immune system play a role in creating inflammation when required to deal with an infection or injury. Inflammation is, therefore, vital to health and survival.

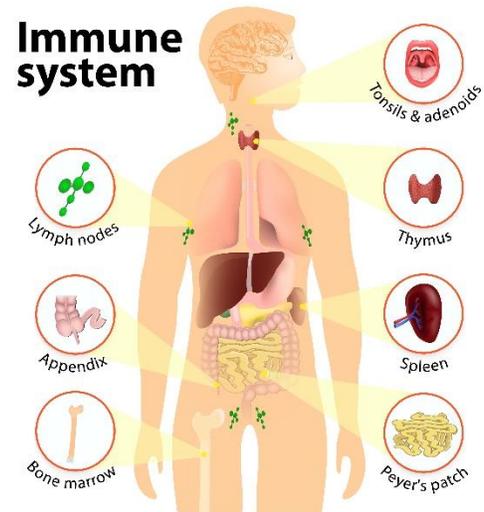
What Does Normal Inflammation Look Like?

When inflammation is healthy and normal, it becomes activated in response to an infection or injury.

Let's say you cut yourself by accident. Your immune system gets a red alert. Injury has occurred! It must respond right away. So, it marshals all its forces, as listed above, to address that injury and help it heal.

First, cells of the immune system travel to the injury site and rev up the inflammatory response. This is what causes the redness and swelling that you may see in a wound. The swelling helps to isolate any foreign substances (such as bacteria) in the injured area to keep them from contaminating any other part of the body. It also signals other cells to come in and get to work repairing the damage.

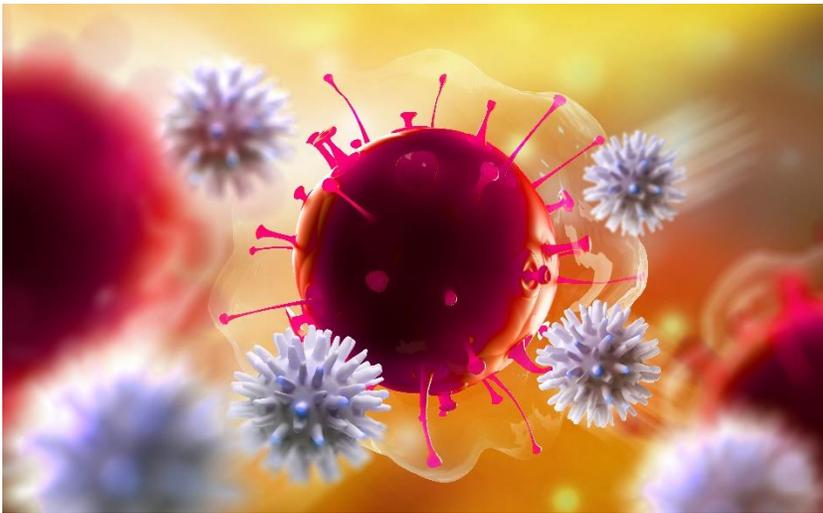
The main workers are the immune system's white blood cells. These cells come in and "eat" the germs or dead and damaged cells. When their job is done, they die. That's when you may see that yellow pus in the wound—it is a collection of dead tissue, dead bacteria, and live and dead white blood cells.



Once the wound is cleaned of invaders and dead and damaged cells, other cells can come in and go to work regenerating the skin and tissues, closing the wound, and healing the area. If everything goes as planned, it is considered a successful immune response. All of the immune cells “go home,” so to speak, and everything calms down and goes back to normal.

What Does Normal Inflammation Look Like During Infection?

If your body is invaded by bacteria or a virus and you develop an infection—like the flu—the immune system responds similarly.



First, the mere presence of the bacteria or virus triggers the immune system. It recognizes that this is *not* a natural part of the body. Instead, it is a foreign invader that must be quickly destroyed before it causes harm.

If such an invader enters the body, certain white blood cells—like the B-cells—recognize it and begin to produce antibodies. These antibodies attach to the invader to signal other cells in the immune system to attack

and destroy it. Indeed, antibodies are like little targets placed on bad bacteria or viruses.

Then other cells like the T-cells and natural killer cells go to work destroying the marked invaders. If all goes well, they manage to destroy enough of them that you are healed from the infection and returned to health.

Once that happens, the immune system will turn off the alert and go back to normal.

The Stages of an Inflammatory Response

We can go a little deeper to examine a typical inflammatory response in stages.

Stage 1: Red Alert

Something induces the inflammatory response. It may be a virus, bacteria, or an injury. Whatever it is, it causes the immune system to signal a red alert to the danger.

Stage 2: Targeting

Various immune cells detect the invaders and send signals to other cells warning about them. In essence, they are saying, “The invaders are here! Come help!” They also produce other cells that will help create inflammation.

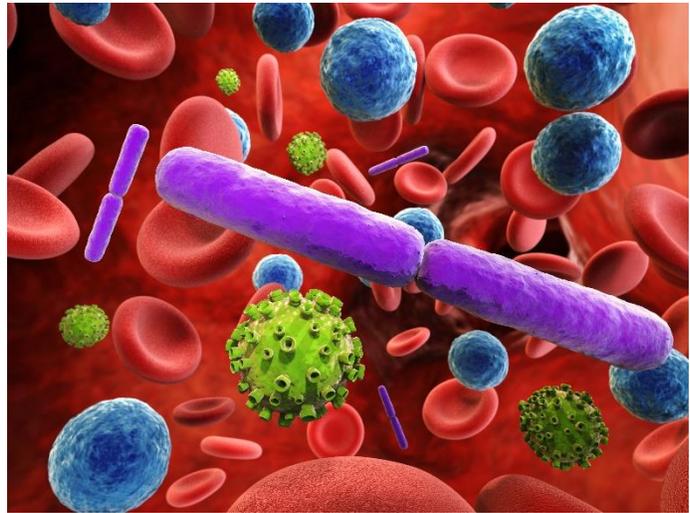
Stage 3: Bring in the Troops

The inflammatory cells target certain tissues to create changes within them. They widen blood vessels to allow more blood to the area, induce redness and swelling, and make it easier for fighting immune cells to flow in.

Stage 4: Target and Destroy

Finally, the warriors of the immune system rush in and destroy the invading pathogens.

Depending on the type of injury or infection, the various cells involved will vary their approach to address that particular problem. Viral infections, for example, may induce the production of different immune cells than parasitic infections. A tissue injury, in turn, may inspire a faster inflammation response to encourage immediate repair and healing.



A Healthy Immune System Knows When to Quit

One hallmark of a healthy immune system is this: It knows when to stop.

Once the injury is healed or the infection cleared, a healthy immune system will terminate the inflammatory response and transition to its "wait and watch" state. It's not as simple as hitting the "off" button, however. Several key mechanisms are involved in determining that yes, everything is fixed, and yes, we can all relax now.

Sometimes the "off switch," however, doesn't work as it should. Something interferes with the signals, so the inflammation may persist even though it's not needed anymore. This may occur if there is a chronic infection, unrepaired tissue damage, or some byproducts of the infection left behind that the immune system mistakenly views as invaders that must be eliminated.

In addition, there are many situations where the immune system revs up the inflammatory response for an unknown reason, and also fails to turn it off. This is when chronic inflammation occurs—inflammation that continues without end.

The Inflammatory Response is Complicated

To sum it up, we can say that inflammation is largely the body’s defense against things that might harm it. It enables the body to fight off bacteria, viruses, and other toxins whether they are introduced via an injury or infection.



It is one of the immune system’s first responses and tends to stick around until the injury or infection has healed. Its job is to address the problem and return the body to homeostasis—balance.

We’ve described this process as simply as possible, but keep in mind that the immune system and the inflammatory response are quite complex. All of the different players must work correctly to mount a successful response to an infection or injury, and then again when it’s time to relax, calm down, and hit the

“off switch.”

As long as it’s healthy, the immune system and its main tool—inflammation—will protect your body from harmful substances that could make you sick, and will help clean up and heal injured areas. Symptoms may include redness, warmth, swelling, and pain, but often inflammation does its job quietly, and you won’t notice any symptoms at all. You’ll simply get better and go on with your life.

If the immune system is not working properly, however, a wide variety of problems may develop. We’ll examine those in a future chapter.

Chapter 2

When Does Inflammation Become Dangerous?

In the last chapter, we examined how the immune system works when all is well. A healthy immune system responds to an injury or infection by inducing inflammation. Once the problem is taken care of, it “turns off” the inflammation and goes back to watching and waiting for the next emergency.

Unfortunately, this response doesn't always go as planned. Things can go wrong, and when they do, inflammation can carry on for much longer than it needs to. If that happens, it goes from being a helpful process to being a harmful one.



In this chapter, we'll look at how and why that may happen.

Acute Vs. Chronic Inflammation

Inflammation is typically characterized as being either acute or chronic.

Acute Inflammation

This is a fast and short-term type of inflammation. You've probably experienced it. It is the redness, warmth, swelling, and pain that occurs around tissues and joints in response to an injury. The immune system releases white blood cells to surround and protect the area and then goes to work cleaning out and restoring the injured area.

The process works similarly if you have a virus like a cold or the flu. The immune system reacts quickly, identifying the invaders, targeting them, then calling in the fighter cells to destroy and eliminate them.

The main characteristic of acute inflammation is that it *does not last*. It revs up immediately, does its job to address the problem, then goes away, usually within a period of days. It's considered a “controlled” type of inflammation that is generally beneficial to the body.

Chronic Inflammation



This is the opposite of acute inflammation in that it *goes on*. Rather than turning on and then turning off, it doesn't turn off. The immune system continues to send inflammatory cells to the area even when there may not be a reason to. It may last for several months to years.

Whereas acute inflammation has an obvious cause—you were injured or infected—chronic inflammation can be confusing. Why is it still going on? It's not always easy to tell.

But the one clear characteristic is that the immune system is not turning it off. This may be because the immune system itself is malfunctioning, or it is mistakenly seeing something as an invader that it must continue to attack.

Why Does the Inflammation Continue?

Scientists don't have all the answers as to why the inflammation fails to turn off sometimes. But they do know that all of the following can cause it to continue:

- **The infection is still there:** For whatever reason, the immune system was not able to fully eradicate the infection. There may still be bacteria, parasites, or fungi around that remain in the tissues for a long time. As long as they are there, the immune system will keep the inflammation going in the hope of getting rid of it.
- **Exposure continues:** You may continue to be exposed to the foreign invader. Maybe you work around chemicals or other toxins, or you're regularly inhaling contaminated dust. The immune system will identify the invaders and continue to try to eliminate them day after day, creating chronic inflammation.
- **The immune system has malfunctioned:** If you have an autoimmune disorder, such as rheumatoid arthritis or lupus, that means the immune system is malfunctioning. It is seeing "friendly" tissues such as those in your joints or skin as invaders and is trying to attack and eliminate them via inflammation. Since you can't eliminate your own bodily tissues, this type of inflammation can become chronic.
- **Defective immune cells:** There are a lot of different types of cells involved in the inflammatory response. If one group isn't working right, others won't receive the messages they need to receive—that the problem has been solved. So, they will think they have to continue fighting.
- **Recurrent acute inflammation:** Let's say you injure the same area over and over again. At first, acute inflammation solves the problem and heals the area. But over time, this repeated issue may cause the immune system to malfunction, and believe it needs to stay constantly vigilant in that area. That means chronic inflammation.

- **Unhealthy changes:** Sometimes the body undergoes stress that inspires inflammation. It may be a chronic disease, autoimmune disorder, weight gain, psychological stress, poor nutrition, exposure to chemicals or allergens, or more. The immune system responds, then continues to respond, creating chronic inflammation.

How Chronic Inflammation Damages the Body

Chronic inflammation typically proceeds on a low level. It's like turning the stove down and simmering your food. It may take a long time for this type of inflammation to cause damage, but eventually, it will. What sort of effects it has depends on a few factors, such as where it's occurring, the types of tissues it's affecting, and how long it's been occurring.

It's also important to remember that scientists are still learning about this process. In some cases, for instance, it's unclear whether the inflammation caused the damage, or if it's present in that area because something else caused damage that stimulated the inflammatory response.

Damages the Digestive System

If you have chronic inflammation in the digestive system, it can damage the intestinal tissues, leading to inflammatory diseases like ulcerative colitis and Crohn's disease.



Harms the Joints

If chronic inflammation occurs in the joints, it can seriously damage the tissue and cartilage, causing stiffness, pain, and joint deterioration.

Leads to Heart Disease

Inflammation in the blood vessels can trigger artery narrowing and blood clots, which may lead to a heart attack or stroke.

Increases the Risk of Cancer

When chronic inflammation occurs, it can weaken the overall immune system, making it less able to fight off cancer cells. That may lead to cancer cell growth and tumors.

Causes Breathing Problems

If inflammation sets up shop in the lungs, it can damage tissues there, cause fluid to accumulate, and airways to narrow.

Associated with Sleep Issues

Those who fail to get the recommended 7-8 hours of sleep per night, or who regularly have their sleep schedules interrupted (such as with shift work), are more at risk for increased inflammation.



Messes with Oral Health

Gum disease is an example of inflammation in the mouth. If it is not treated successfully, it can gradually damage the tissue and weaken the skeletal structure surrounding the teeth. Inflamed gums are also linked to other conditions like heart disease because the harmful bacteria in the mouth are allowed to trigger inflammation elsewhere in the body.

Often Exists with Weight Gain

Excess fat in the body is known to be associated with chronic inflammation. Obesity can cause the levels of inflammatory cells to rise, inspiring chronic inflammation and creating damage that may lead to diabetes.

Damages Bone

When chronic inflammation exists in the body, it's thought to disrupt the natural process of regenerating bone. It may interfere with bone growth and even contribute to bone loss.

Harms the Skin

Sometimes inflammation attacks the skin. People with rosacea and psoriasis experience this firsthand. Over time, chronic inflammation of the skin can lead to barrier breakdown and premature aging.

Hurts the Brain

Inflammation sometimes makes its way to the brain. There, it can damage the cells to the point that they no longer function as they should, leading to dementia and Alzheimer's disease. Brain inflammation is also thought to be related to depression and post-traumatic stress disorder (PTSD).

Causes Liver Damage

Inflammation in the liver can create scar tissue that over time, limits the ability of the liver to do its job. If too much is destroyed by scar tissue, the liver may fail.

Scars the Kidneys

Similarly, inflammation in the kidneys can lead to scarring, which may cause chronic kidney disease.

What are the Risk Factors Associated with Chronic Inflammation?

Below are the most common factors that may increase your risk of chronic inflammation:

- **Age:** Increasing age is associated with higher levels of inflammation. This may be because of disease, free-radical damage, increased body fat, or other factors.
- **Obesity:** Many studies have shown that fat tissue secretes cells that encourage inflammation. The more fat cells you have, then, the more inflammation you're likely to have.
- **Diet:** Some foods help tame inflammation, whereas other foods—unhealthy items like those high in refined sugars—are associated with the production of pro-inflammatory molecules.
- **Smoking:** Cigarette smoking is associated with reducing the number of anti-inflammatory molecules you have in your body. That can cause increased inflammation.
- **Stress and Sleep Disorders:** Physical and emotional stress is associated with the release of inflammatory cells.



As you can see, chronic inflammation is likely to be associated with most any health problem a person may experience. Worse, it tends to be a self-perpetuating process: as the inflammation causes damage, the damaged cells signal for help. The immune system responds by sending in more cells that inspire *more* inflammation. This accelerates the damage or the disease, causing a downward spiral.

This is why whenever you have an injury or disease, doctors will often try to bring the inflammation down. Doing so can help limit the damage and encourage healing.

Chapter 3

What Causes Dangerous Inflammation?

We understand now that it's best to avoid chronic inflammation, as it's not good for our health. This is the "bad," dangerous type of inflammation that can go on for months or even years, damaging tissues and leading to other more serious complications.

But what causes inflammation to turn "bad" in the first place?

Inflammation Is the Body's Response to Most Everything

Research shows us that the body has many ways to respond to harmful incidences, including injuries, infections, traumas, stress, diseases, and more.



But there's one thing that remains constant no matter what the threat: inflammation. Regardless of whether the problem was caused by you cutting your finger, catching a cold, developing rheumatoid arthritis, or recovering from pneumonia, the body will respond by stimulating inflammation.

Scientists say that the "cascade of inflammation" is the body's way to maintain its integrity in response to small and large injuries. It begins when the body senses danger of any sort, which may include injuries and infection, but also emotional stress and exposure to environmental toxins.

In turn, researchers think that the development and progression of chronic diseases (like heart disease and diabetes) are linked to "uncontrolled or dysfunctional inflammation," regardless of the nature of the problem.

Because the immune system is so complex and involves so many players within the body, it can easily go wrong. Messengers communicate between the brain and the rest of the body, and between the central nervous system (CNS) and the brain.

When working correctly, it is a finely tuned instrument with everyone playing their parts. But if someone along the way overreacts to a potential “danger” signal, inflammation may continue when it should stop.

The bottom line is that constant or repetitive activation of the immune system, for whatever reason, can lead to long-term, low-grade inflammation. This chronic inflammation then disrupts multiple systems in the body due to its effects on the nervous system as well as bodily tissues.

Indeed, according to scientists writing in a 2018 study, “Most disease—acute and chronic—results from inflammation.”

7 Potential Causes of Dangerous Inflammation

The question then becomes, “Why does this type of dangerous inflammation occur?”

This is a complex question, and scientists are still digging into it. From what we know so far, here are several possible reasons.

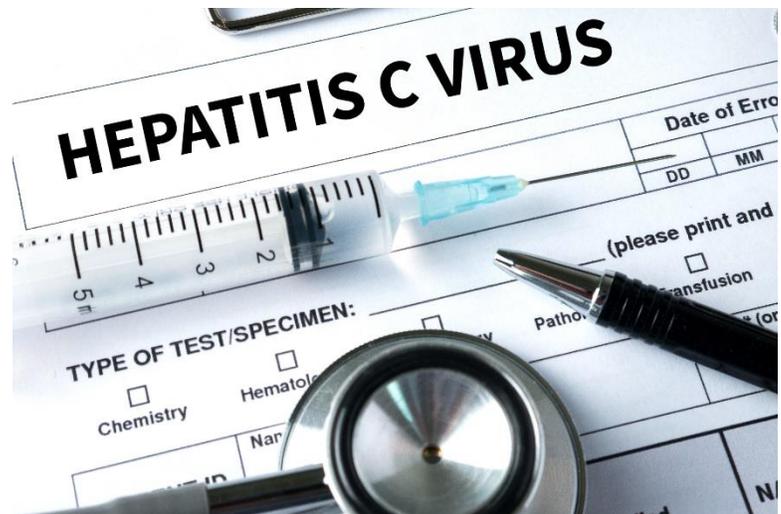
1. Chronic Infections

If you catch a cold or the flu, your immune system is likely to do a pretty good job of eradicating that infection within a couple of weeks. As long as you take good care of yourself, you should be feeling better soon. With these types of infections, the immune system does its job and then turns off.

Chronic infections, however, like hepatitis C, the Epstein-Barr virus, HIV, and others are linked to chronic inflammation. Studies show that in some cases, they can cause premature aging of the immune system, in large part because of the increase in pro-inflammatory type cells.

Scientists aren’t sure that chronic infections are the “primary driver” behind chronic inflammation, however. People with these infections often have chronic inflammation, but it could be that environmental or genetic factors influence their health outcomes.

It’s interesting, though, as several studies have found that common chronic infections may account for up to 40 percent of newly developed cardiovascular disease cases. In other words, some sort of infection—bacterial, viral, or fungal—can stimulate inflammation to the extent that it can damage the arteries and lead to heart disease.



2. Physical Inactivity

Physical inactivity, in general, is associated with persistent, systemic (body-wide) low-grade inflammation.



Researchers already know that physical inactivity is a primary cause of most chronic diseases. How sitting on your couch translates to heart disease, however, can be complicated. We know, however, that the more you sit on that couch, the more likely you'll be to suffer from chronic inflammation.

In a 2020 study, for instance, researchers reported that both physical inactivity and abdominal fat “are associated with persistent systemic low-grade inflammation.” They added that according to available evidence, regular exercise and weight loss both protect against diseases associated with this type of dangerous inflammation.

3. Obesity

When you have an excess of fat cells in the body, these cells release inflammatory messengers that in turn, create chronic inflammation and oxidative stress. This stimulates the liver to release proteins that create even more inflammation.

In other words, excess fat cells are seen as “injuries” by the body, so it responds with inflammation.

Indeed, overweight and obesity create a vicious cycle in the body that keeps inflammation going and going. As it wreaks havoc throughout various systems, it can lead to cardiovascular disease, type 2 diabetes, cancer, and more.

4. Diet

You know it’s good for you to eat a healthy diet. It can help you maintain a healthy weight, which can, in turn, help you avoid chronic inflammation.

But eating good food is not only about your weight. Studies have found that some foods fight inflammation, while others encourage it. So-called pro-inflammatory foods include fried foods, fast foods, sodas, high-sugar foods, refined carbohydrates (such as those in white bread and pasta), and red meat.

Foods that fight or calm inflammation include fresh fruits and vegetables, yogurt, nuts, fatty fish, and olive oil. They contain protective compounds like antioxidants and polyphenols that contribute to a healthy immune system.

5. Unbalanced Microbiome

Everyone has billions of bacteria and other microbes in their guts. These communities are referred to as the "microbiome." If you have more "friendly" bacteria that are helping you than "unfriendly" microbes that are hurting you, you will have a healthy gut. That healthy gut encourages your immune system to be healthy too.

If that microbiome becomes unbalanced, however, and the "bad" bacteria take over, it becomes unhealthy. That is seen as a problem by the body, so of course, it responds with inflammation.



How does this imbalance occur? It could be because you eat an unhealthy diet, or you had to go through a round of antibiotics for an infection. (Antibiotics kill both good and bad bacteria.) According to a 2020 study, the gut microbiome is influenced by genetics, diet, antibiotics, and inflammation, and is closely linked to diseases like obesity and inflammatory bowel disease.

6. Stress

When you're stressed, the body feels threatened and naturally releases messengers that get ready to protect you. This can help your body ready itself to deal with any injury you may suffer while in a stressful situation. But when the stress passes, the immune system returns to normal.

In today's world, though, stress can become a way of life. Every day you're feeling stressed out. That's called "chronic stress," and it can lead to diseases like cardiovascular disease, diabetes, non-alcoholic fatty liver disease, depression, Alzheimer's disease, and more.

For a long time, scientists weren't sure how stress could contribute to the development of these diseases. Now, however, they think that inflammation may play a role.

It seems that stress can activate the inflammatory response in the brain and body, stimulating immune responses. During acute (short-term) stress, these responses turn down the immune system. This is why you may be more likely to catch a cold during a stressful time.

But during chronic (long-term) stress, they can enhance the activation of inflammation, turning it up. Some research has even suggested that chronic stress can interfere with the body's ability to shut down its immune system.

Chronic stress also tends to exacerbate any inflammation you may already have, making it worse. So, if you're overweight *and* suffering from chronic stress, these two conditions will feed the inflammatory fire.

7. Social Isolation

Feeling socially isolated or lonely can create a unique type of psychological stress. This type of stress, scientists have found, can act like chronic stress, increasing inflammation.



Humans are naturally social creatures. We thrive in positive, supportive, social groups. When isolated, we can feel at risk, even if we don't realize it.

Recent studies have reported a strong link between emotional disorders like depression and anxiety and increased inflammation. In 2019, they noted that pro-inflammatory messengers in the immune system communicate with the brain and can either cause emotional changes or respond to emotional changes

by increasing inflammation.

In a later 2021 study, scientists analyzed data on 624 people who were isolated during the COVID-19 pandemic. They found that feeling isolated or lonely was associated with a higher level of pro-inflammatory markers in the blood.

Other studies have found that depressed individuals not only suffer from chronic low-grade inflammation but may also have a more reactive response to acute stress, where inflammation spikes even higher.

8. Disturbed Sleep

The recommendation is to get 7-8 hours of sleep per night for good health. Sleep deprivation or inconsistent sleep is now known to increase your risk for disease. Scientists think inflammation has something to do with that.

That's because studies have suggested that inconsistent sleep is associated with elevated inflammatory cells in the blood. Even one night of sleep disruption—such as what may occur with on-call physicians—can impact the immune system this way.

In a review of 72 studies, researchers found that sleep disturbance (being interrupted while sleeping) was associated with increases in markers of inflammation. Getting too much, as well, spiked inflammation.

In a recent 2021 study, scientists found that poor sleep quality and duration could stimulate inflammation which, in turn, could then exacerbate sleep disturbances. This can create another vicious circle. You have trouble sleeping, which inspires inflammation, which can make it even harder to get the sleep you need.

9. Exposure to Toxins

Exposure to environmental toxins such as air pollutants, hazardous waste products, industrial chemicals, and tobacco smoke can encourage inflammation.

Scientists are just learning about this, but they have found that chemicals and chemical mixtures can have an impact on the cells of the immune system. Bisphenol-A (BPA), for instance—found in some plastics—is known to have effects on cells involved in tumor-associated inflammation.



In a 2021 study, researchers found that toxic chemicals in drinking water, called trihalomethanes (THMs), were involved in the inflammation process. In another study on air pollution, researchers found that exposure to particulate matter significantly increased the presence of pro-inflammatory cells. It makes sense—the body sees these toxins as invaders, and therefore stimulates the immune system to eradicate them.

Other studies are ongoing to determine the effect that various toxins may have on inflammation and disease.

10. Autoimmune Disorders

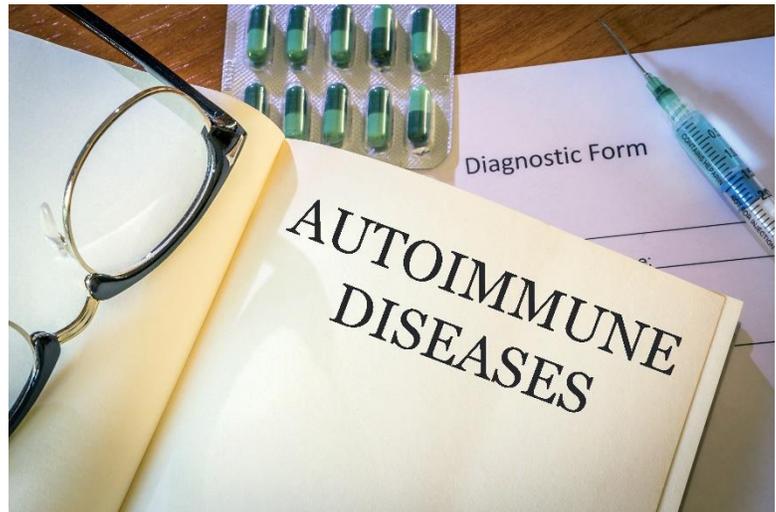
Autoimmune disorders such as lupus, rheumatoid arthritis, inflammatory bowel disease, and multiple sclerosis (MS), cause the immune system to malfunction. It begins to see the body's own tissues as invaders and tries to eradicate them. That means inflammation.

Scientists know that inflammatory responses play an essential role in the development of autoimmune disorders. It is the inflammation that damages the joints in those with rheumatoid arthritis, for instance. That's why doctors prescribe medications and other treatments to try to get that inflammation down.

Most Causes of Dangerous Inflammation Can Be Avoided

We've listed some of the most common causes of chronic, dangerous inflammation. Keep in mind, however, that inflammation is the body's go-to when responding to pretty much any injury, illness, or other danger. That means that the possibility of your inflammation level being too high is a very real threat to your health.

Fortunately, you can help protect yourself from almost all causes of chronic inflammation, except autoimmune disorders. We'll talk more about how to do that in future chapters.



Chapter 4

Signs You May Have Chronic Inflammation

You now know that chronic inflammation can exist without showing any symptoms at all. That's what makes it so dangerous. It can damage tissues and blood vessels over time without you being aware of it.

But as the inflammation gets worse, you may start to notice some signs. We talk about those in this chapter.

Symptoms of Acute Inflammation

In review, acute inflammation is the short-term form of inflammation. Chronic inflammation is a long-term, more dangerous form.

During short-term, acute inflammation, you may notice pain, heat, redness, and swelling at the site of the wound or injury. If you cut yourself, for instance, you'll notice these symptoms around the wound as it heals. Or if you have a cold, you'll notice the swelling in your sinuses, throat, or lymph nodes.



Examples of conditions that cause acute inflammation include:

- Bronchitis, where the airways become inflamed
- A sore throat related to the flu
- Red, inflamed rashes on the skin
- Cuts and scratches
- A swollen bruise caused by a traumatic impact

This type of inflammation develops quickly in response to the injury or illness, then once the area is healed or the infection eradicated, it goes away.

Signs of Chronic Inflammation

Chronic or lasting inflammation is not quite so clear-cut. You may not notice it at all, or there may be signs, but you may not recognize them, attributing them to something else.

Chronic inflammation can manifest in different ways. Often it accompanies some other disease, like heart disease or diabetes. If you have a disease like that, you can assume that you probably have chronic inflammation too.

Other times, chronic inflammation may exist without a disease diagnosis.

Let's explore some of the signs that may signal chronic inflammation has taken up residence inside your body. If you have any of these symptoms, talk to your doctor about how you may be able to reduce the inflammation and encourage healing.

1. Low Back Pain

Muscle strain, slipped discs, or more serious conditions like ankylosing spondylitis (AS) may all involve chronic inflammation. The body recognizes a muscle strain or slipped disc and will use inflammation to try to heal the area. If it doesn't heal correctly, however, or is repeatedly injured, the inflammation may stick around.

A condition like AS can be worse, as it involves chronic inflammation that attacks the spine, causing pain and stiffness.



2. Skin Rashes and Redness

Skin conditions like eczema, psoriasis, and rosacea all involve chronic inflammation. It is a key characteristic of the redness and rashes that develop, heal, then flare up again. Even sensitive skin is prone to frequent inflammation in reaction to a variety of triggers, such as certain skincare ingredients, detergents, weather, environmental pollution, and more.

3. Aches and Pains

General aches and pains in your muscles and joints are typically associated with chronic inflammation. It could be that you're suffering from arthritis or muscle strain after a hard workout, both of which cause inflammation. But it could also be that the inflammation is going on body-wide, and only shows up in these areas as pain and swelling.

4. Fatigue and Low Energy

Everyone can feel tired now and then. But if you're struggling with daily fatigue no matter how well you sleep at night, you could be suffering from chronic inflammation. The feeling is similar to that run-down feeling you may have when you're sick. It's because your immune system is working overtime. Inflammation requires cellular energy, which depletes you of the fuel you need to feel fully energized.



5. Poor Digestion

It's common to have an upset stomach now and then. But if you're struggling with issues like bloating, gas, abdominal pain, constipation, and loose stools regularly, you may have an issue with inflammation.

When inflammation attacks the gut, it can damage the intestines to the point that they start to "leak" microbes into the rest of the body. This stimulates more inflammation, creating a vicious cycle that can lead to digestive problems and other health issues.

Some studies have even indicated that gastroesophageal reflux disease (GERD) may be a part of the body's natural inflammatory response. This indicates that digestive issues could be closely tied to chronic inflammation.

6. Excessive Mucus Production

Clearing your throat. Blowing your nose. Waking up with phlegm in your throat. All these are signs that your sinuses may be producing excess mucus, which in turn, can be a sign of chronic inflammation.

Your sinuses (and sometimes your lungs) produce phlegm as an immune response. It can help protect cells in the lining of the respiratory system. It also results in coughing, sneezing, and throat-clearing.

7. Swollen Lymph Nodes

There are many lymph nodes in the body. The ones you can feel are located on the neck, under the armpits, and in the groin area. When these swell up, that's a sign that something is happening with the immune system.

You may have noticed when you have a cold or flu that these lymph nodes swell up enough to become noticeable. (Your doctor will usually check those in your neck for swelling, as that can signal the presence of an infection.) Once your body fights off the infection, the swelling should go down. If it doesn't, you may be dealing with chronic inflammation.

8. Balance Problems

It's common as we get older for balance to become a little more difficult. But if you frequently feel dizzy or off-balance when you walk, that could be a sign of chronic inflammation.

Some inflammatory diseases like multiple sclerosis (MS) and Parkinson's disease attack the body's nerve coatings, making it harder for nerve signals to get through. That can make it more difficult for you to keep your balance. Other inflammatory diseases that cause vision, inner ear, or other sensory problems can affect balance.



9. You Keep Forgetting Things

It's common to forget little things more often as we get older. But research shows that chronic inflammation in the body can lead to a sharper decline in memory—8-12 percent greater.

Earlier studies also show that high levels of a protein (C-reactive protein or CRP) associated with chronic, low-grade inflammation in the brain correlate with memory decline in older adults. Participants with measurable levels of CRP recalled fewer words on a test and had visibly smaller medial temporal lobes in their brains.

10. Your Blood Sugar is High

High blood sugar levels and insulin resistance may be signs of inflammation. Insulin is a hormone that helps control the level of sugar (glucose) in your blood. Inflammation can affect how well your insulin works.

Scientists have found that pro-inflammatory cells can cause insulin resistance by inhibiting how well insulin sends its signals. This can lead to higher blood sugar levels and potentially, to type 2 diabetes.

11. Belly Fat

Your genes largely determine where your body will store fat. If you happen to have an "apple" shape, that means any extra fat will be stored around the belly. This is considered more dangerous to your health than a "pear" shape, where the excess fat is stored in the hips and thighs.

Belly fat is known to secrete inflammatory compounds that drive chronic inflammation. Even if you have just a little belly fat, that's a sign that you may already have some inflammation.

12. Your Blood Pressure Is Creeping

Low-grade inflammation is a primary cause of damaged blood vessels. Over time, it can make them stiff and narrowed, which is what leads to high blood pressure and heart disease. So, if you notice your blood pressure going up, even in small increments, it's something to be mindful of. Take steps to keep it under control, and that will help keep the inflammation under control too.

13. Frequent Infections

In the fall you caught the flu. In the spring you had a cold. Then you picked up the stomach flu in the summer.

Everyone can get sick now and then. But if you seem to catch everything that's going around, that could be a signal that your immune system is overworked.

If you have chronic inflammation going on inside you, your immune system may be less able to protect you from viruses because it's already devoting so many of its resources to keeping the inflammation going.



14. Low-Grade Fever

A fever is one of the hallmark signs of inflammation. When your immune system detects an infection, it increases your body temperature. Bacteria and viruses don't like higher temperatures, and can't replicate as well in them, so it's a good defense against illness.

Like any type of inflammation, a short-term fever can help the body heal. But a chronic, low-grade fever that's only maybe a degree too hot may signal unhealthy, chronic inflammation. You may also feel chronic fatigue and an overall sense of not being well.

15. You Feel Depressed

Low-grade inflammation can cause changes in the way the brain functions, which can make you more susceptible to depression and anxiety. In a 2019 study, researchers noted that in depressed patients, it's common to find elevated levels of inflammatory proteins.

“Chronic exposure to increased inflammation is thought to drive changes in neurotransmitters and neurocircuits that lead to depressive symptoms...” the researchers wrote. They added that inflammation could also interfere with antidepressants, making them less effective.

Diseases Also Signal Chronic Inflammation

Keep in mind that in addition to the signs listed above, various health conditions are also associated with chronic inflammation. If you have one of the following diseases, for instance, you likely have chronic inflammation too:

- Arthritis
- Asthma
- Gum disease
- Inflammatory bowel disease (IBD)
- Heart disease
- Stroke
- Diabetes
- Fatty liver disease
- Endometriosis
- Obesity
- Autoimmune disease (lupus, MS, Parkinson's disease)
- Cancer
- Alzheimer's and other types of dementia



In the next few chapters, we'll examine some of these diseases more closely and how they're related to inflammation.

Chapter 5

How Heart Disease and Inflammation Are Connected

Heart disease remains the leading cause of death for men and women in the United States. One person dies every 36 seconds from cardiovascular disease, with about 659,000 dying each year—one in every four deaths.

For years we’ve been told to keep our cholesterol and blood pressure under control to avoid and manage heart disease. Recent research, however, suggests that because of the role inflammation plays, we should also be doing our best to target inflammation when considering heart health.

Scientists Find Evidence that Inflammation May Play a Role in Heart Disease

As recently as the 1990s, scientists believed that atherosclerosis—the buildup of plaque in blood vessels that can lead to heart attacks and strokes—was caused mainly by excess cholesterol in the blood. That’s why we were all told to cut back on foods that were high in cholesterol, as scientists thought that would help us reduce our risk of heart disease.



But there were holes in this theory. The main one was this: almost half of the heart attacks and strokes in the United States occurred in people who did *not* have high cholesterol. About a quarter of them had no risk factors for cardiovascular disease at all.

What was going on?

Way back in the mid-1880s, German pathologist Rudolf Virchow recognized inflammatory

cells in atherosclerotic plaques. The idea that inflammation could be playing a role in cardiovascular disease failed to gain traction at that time, though, as other scientists weren’t studying it, so there wasn’t any clinical data.

But then in the later 1990s, that changed. In 1997, researchers reported that middle-aged men with high levels of an inflammatory marker known as C-reactive protein (CRP) were at an increased risk for heart attack and stroke despite their cholesterol levels.

That research was led by Dr. Paul Ridker, Director of the Center for Cardiovascular Disease Prevention at the time. He made the discovery rather accidentally. He and his team were studying aspirin and found that the benefit of being on aspirin for heart attack prevention was greater for people who had higher levels of inflammation than those who didn't.

Ridker and others went on to study the connection further. Another study published about the same time showed that angina patients with elevated CRP fared worse than those with normal CRP levels. They had more heart attacks and were more likely to need surgery or to die, whereas those with normal levels of CRP experienced no deaths and required fewer surgeries.

These results showed a definite connection between heart problems and inflammation and indicated how inflammation could worsen health outcomes.

The Inflammation Theory of Heart Disease Gains Traction

In 2004, researchers noted that inflammation occurs in blood vessels in response to injury, oxidation (damage by reactive cells), and infection.

Various other factors—including high blood pressure, diabetes, and smoking—make things worse, initiating chronic inflammation. That inflammation, in turn, exacerbates the plaque buildup in blood vessels, making them more likely to stiffen and narrow, which leads to heart attacks and strokes.

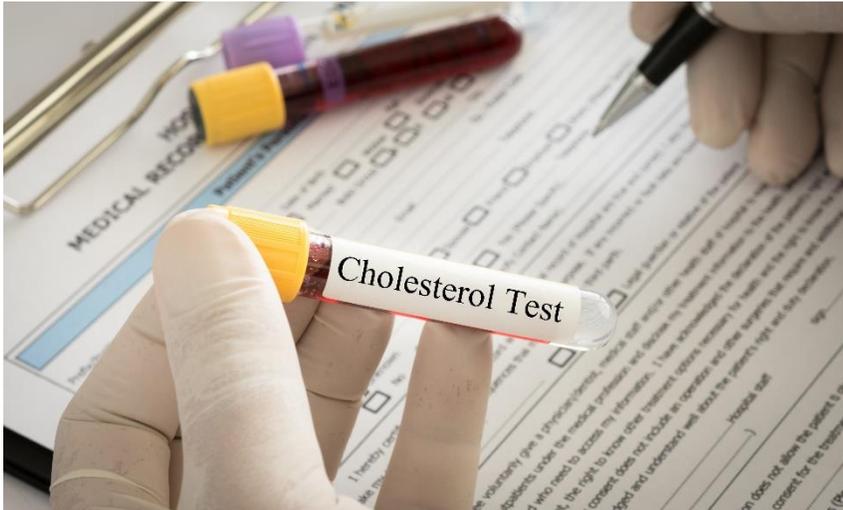


The scientists noted that other studies had shown “strong and consistent relationships between markers of inflammation and risk of future cardiovascular events.” They also found that statin medications—which are frequently used to lower cholesterol levels—could lower levels of C-reactive protein, one of the most well-known inflammatory markers.

CRP remains the primary way to measure cardiovascular disease-related inflammation. These proteins are produced by the liver, which signals inflammation somewhere else in the body. Scientists now know that CRP is tied to an immune system process that has emerged as a key player in atherosclerosis.

We Know More Now About What Role Cholesterol Plays

Today, the idea that cardiovascular disease is an inflammatory condition is broadly accepted in scientific and medical circles. Now scientists are focused on figuring out how it works—why it starts, and how it damages blood vessels.



We now know, for instance, that there are other cells and molecules—in addition to CRP—that contribute to the process of inflammation and blood-vessel damage. This takes us back to cholesterol. When it sticks inside the wall of an artery, the body perceives that as an injury, so it revs up the inflammation. These inflammatory molecules attract white blood cells, which take up residence in the artery wall.

There, they send out more signals to keep the inflammation going. Over time, this process leads to cholesterol deposits hardening and becoming plaque. Then the blood vessels stiffen and narrow, and soon the risk of a blood clot becomes high.

This knowledge has helped clarify the relationship between cholesterol and heart disease. Cholesterol gets the plaque started, but then inflammation takes over from there, making things a lot worse until a heart attack or stroke occurs.

Lowering cholesterol then is still a good idea, but perhaps more important is lowering inflammation. It seems if we can do that, we can prevent atherosclerosis from getting worse.

Indeed, a recent trial showed that this could be an effective route of treatment. Researchers injected an anti-inflammatory drug in people who had a prior heart attack and who also had elevated levels of inflammatory markers.

The results showed that those who received the drug reduced their likelihood of having another heart attack or stroke by 15 percent. The drug also reduced the need for major surgery by 30 percent.

Ridker performed a similar study where he recruited nearly 18,000 people with low cholesterol but elevated CRP levels. He had half of them take a statin drug (which has cholesterol-lowering and anti-inflammatory effects) and the other half a placebo. Those who took the drug saw a 44 percent reduction in their risk of a heart attack or stroke.

Was this outcome because of the statin's ability to lower cholesterol or inflammation? Ridker went back to the research room and launched another study to find out. This time he recruited 10,000 people with

elevated CRP levels who had already had a heart attack. He gave half of them a drug that inhibited inflammation but had no effect on cholesterol. The other half received a placebo.

The results showed that those who received the drug had a 15-17 percent lower chance of having a heart attack or stroke, or of dying from cardiovascular disease, than those who received a placebo.

These studies showed doctors that addressing inflammation could help prevent heart disease or stop it from getting bad enough to result in a heart attack or stroke.

Which Medications May Help Tame Cardiovascular-Related Inflammation?

The process of finding a medication that will make noticeable results in cardiovascular-related inflammation has not been easy. The drug used in the Ridker trial above turned out to be too expensive for widespread use, and the company that made it decided not to seek regulatory approval.

Some trials with other drugs, meanwhile, have not found such positive benefits. When scientists tried low-dose methotrexate for a 2019 study, they had to stop the trial early because it was not working. It did not lower inflammation levels any more than a placebo did.



The immune system is complicated, and there are many cells involved. It could be that this

particular medication didn't target the right ones. So, researchers are trying other options. One medication called "colchicine" is showing promise. In one study involving nearly 5,000 participants, it resulted in a 23 percent reduction in future cardiac events or death.

In a slightly larger trial, the drug reduced the risk of these events by 31 percent. Colchicine is also widely available and cheap—it's been around for more than a century. Some cardiologists are already prescribing it to certain patients with cardiovascular disease.

Meanwhile, scientists continue to conduct more trials involving colchicine and other anti-inflammatory drugs. It may not be long before the standard treatment for cardiovascular disease includes a three-pronged approach:

1. Control cholesterol levels
2. Control blood pressure
3. Control inflammation

We Can Reduce Risk of Cardiovascular Disease with Healthy Habits

While scientists search for more drugs to address heart disease, we all have another option—a healthy lifestyle.



Indeed, adopting certain healthy lifestyle habits like eating a healthy diet, avoiding smoking, exercising regularly, and maintaining a healthy weight can all help us reduce the risk of cardiovascular disease. These habits do the work of any medication—they keep cholesterol under control, prevent high blood pressure, and help tame inflammation.

Unfortunately, most adults fail to follow these guidelines. According to a 2005 study of more than 153,000 adults, few

followed current health recommendations. The scientists looked at four main healthy lifestyle habits:

1. Not smoking
2. Maintaining a healthy weight
3. Consuming 5 or more fruits and vegetables a day
4. Regular physical activity (30 minutes or more 5 times a week)

The results showed:

- 76 percent of adults were nonsmokers
- Less than half (40.1 percent) had a healthy weight
- Only 23.3 percent ate 5 or more fruits and vegetables a day
- Only 22.2 percent stayed physically active

When examining all four habits, researchers found that only 3 percent of those studied regularly adhered to all four.

This is too bad, as healthy lifestyle habits are powerful. In a 2020 review, researchers pointed out: “Multiple intervention studies have demonstrated that lifestyle changes can lead to reduced inflammation and improved health.” They added that inflammation biomarkers improved in patients who consumed a certain amount of fiber per day, for instance. Losing weight showed similar results.

You’ll find more about how you can adopt inflammation-lowering healthy habits in future chapters. For now, know that what you do on a daily basis really matters!

Chapter 6

How Inflammation Sparks and Drives Cancer

Inflammation is strongly connected to the development of cancer and the promotion of cancerous tumors. The connection is so powerful that oncologists typically make targeting inflammation part of their strategy when treating cancer.

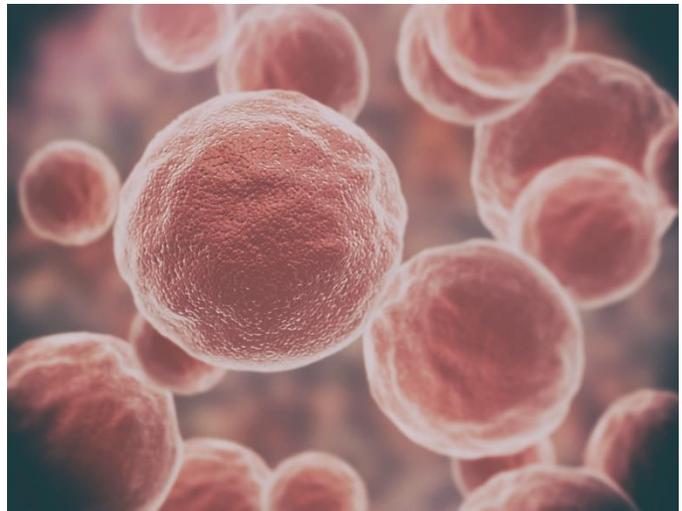
In this chapter, we look at how inflammation drives the formation of cancerous tumors, then continues to encourage tumor growth, progression, and metastasis, where cancer spreads to other parts of the body.

Ways Chronic Inflammation Triggers Cancer Cell Growth

It was back in the second half of the 1800s that German scientist and physician Rudolf Virchow first observed that cancer often developed at sites of chronic inflammation.

But it's been only in recent years that scientists have realized that chronic inflammation can be a primary risk factor for cancer as well as other serious health conditions. Some believe that it's become more noticeable lately because of the increase in obesity, which drives more inflammation-dependent diseases like cancer.

According to Cancer Treatment Centers of America, as many as one in five cancers are believed to be caused or influenced by inflammation. A 2017 study put that percentage higher, at 25 percent or one in four.



Let's look at some of the ways that inflammation can trigger the growth of cancer cells.

Inflammation Damages DNA

Over time, chronic inflammation can damage cellular DNA, which affects how cells grow and divide.

When the body is struggling with chronic inflammation, inflammatory cells regularly release reactive oxygen and nitrogen species, which are unstable molecules (free radicals). These molecules can damage DNA, and DNA damage is known to be a root cause of cancer.

Inflammation Damages Repair Proteins

The DNA in every cell of the body is always in danger of becoming damaged. Because of that, each cell contains proteins whose job it is to repair that damage. That means that most DNA damage gets repaired straight away because of these proteins.

But if the damage occurs to a gene that makes a DNA repair protein—which is possible from chronic inflammation—a cell has less ability to repair itself. Errors will build up in other genes over time, which eventually will allow cancer to form.

Inflammation Stimulates Blood Vessel Growth

The inflammatory process produces molecules called cytokines (immune cells) that stimulate the growth of blood vessels. This results in the formation of new blood vessels, allowing more blood to flow in.



When all is normal, this process brings blood to the injured area to help it heal. During chronic inflammation, however, this process doesn't stop, so new blood vessels continue to form, bringing oxygen and nutrients in and priming the area for tumor growth.

The immune system is highly connected to the “endothelium,” which is the tissue lining the inside of blood vessels. This lining is made up of billions of endothelial cells, which respond to signals from the

immune system.

During chronic inflammation, signals inspire the endothelial cells to dilate blood vessels so more blood can come through. If the inflammation signals continue, the endothelial cells increase and create new blood vessels, allowing more inflammatory cells in, which sustains the inflammation.

This in itself doesn't cause cancer. But paired with the DNA damage mentioned above, it can trigger the cancer process.

Chronic Inflammation Suppresses Immunity

While these two things are going on—DNA damage and proliferation of blood vessels—the body's immune system is overworked. Because of that, it may not respond to the presence of cancerous cells as it usually would.

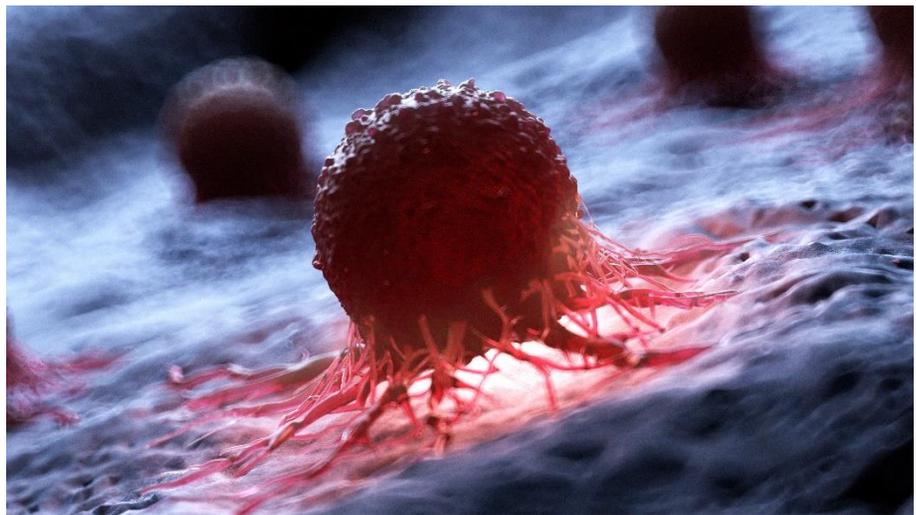
Typically, the immune system recognizes and destroys cancer cells all the time. If we didn't have an immune system, we would develop cancer a lot more often. That's because sometimes when cells divide, errors occur and cells become damaged.

When all is well, the immune system notices these cellular mistakes and handles them before they can cause trouble. Killer T-cells patrol our bodies and destroy damaged cells before they can start to form tumors.

In an overworked immune system, however, this process may not work as well, allowing some of the cancer cells to survive under the radar. Then as the tumor grows, the rate of growth begins to match the rate at which the immune system can control it. Eventually, the immune system loses the battle and the tumor takes hold.

Tumor-Related Inflammation Suppresses Immune System

In addition to the overall immune system falling behind, once the tumor begins to grow, it releases its own inflammatory cells. These activate genes that further suppress the immune system's response to cancerous cells—essentially creating a blind spot in the immune system's surveillance.



It's as if these cells are saying, "Don't look over here! Nothing to see here!"

Chronic Inflammation Helps Set Up an Environment Around the Tumor

Scientists now know that chronic inflammation "shapes the tumor microenvironment," meaning the environment directly around the tumor. It's like the tumor sets up residence in your body and then sets to redecorating to make things more to its liking.

In doing this, it ramps up inflammation, sets up camouflage so the immune system doesn't see it as well, and promotes its own growth.

Chronic Inflammation Also Affects Cancer Treatment

Because the link between chronic inflammation and the development and growth of tumors is so well established, doctors target inflammation when treating patients with cancer, and when trying to prevent cancer growth in the first place.

You may be surprised to learn that lifestyle changes—including eating a healthy diet, exercising, stopping smoking, and moderating alcohol intake—can reduce the risk of cancer-related deaths. These are among the first recommendations a doctor is likely to give anyone seeking to prevent cancer or to improve their outcomes once they have it.

Anti-Inflammatory Medications to Treat Cancer

Research shows that certain anti-inflammatory drugs, including aspirin, can significantly reduce cancer risk because of their ability to reduce inflammation. Studies have indicated that aspirin may reduce the risk of colon cancer by 40-50 percent, and may also be preventative for lung, esophagus, and stomach cancer.



Because of their potential side effects (stomach bleeding, kidney failure, and others), however, doctors will likely take into consideration each patient’s medical history before recommending anti-inflammatory medications for prevention. Future research will help us better understand their capabilities.

So far, two anti-inflammatory drugs called celecoxib and diclofenac have been approved for preventing cancer in some high-risk patients. Scientists also have evidence that statins (cholesterol-

lowering drugs) can help reduce levels of inflammatory cells, and also may reduce the risk of several types of cancer including breast cancer. There isn’t enough evidence yet for these to be approved as cancer-preventive medications.

Metformin, a drug used to treat type 2 diabetes, has been found to help decrease the incidence of colon, breast, lung, prostate, ovarian, and pancreatic cancers partly through its anti-inflammatory properties.

Corticosteroids, which are often used to prevent nausea and vomiting in those going through chemotherapy, are also highly effective anti-inflammatory drugs that have shown anti-cancer capabilities. Scientists are looking into how these may be used during cancer treatments to improve health outcomes.

In addition to these, scientists are looking into new drugs that would target various parts of the inflammatory process to prevent and treat cancer. As we've noted, though, the immune process is complicated, so it's still unclear which types of anti-inflammatory drugs may work best for what types of cancer and in what stages.

Indeed, it looks like a more individualized response may be key. In a 2019 study, researchers noted that the biggest challenge will be “the timely identification of the most efficient combination for each individual cancer patient...”

How Chronic Inflammation Sets the Stage for Cancer

Though exactly how chronic inflammation encourages cancerous changes in the body can get complicated, what's important to understand is that the mere presence of this type of destructive inflammation can increase your risk for cancer.

In general, the longer the inflammation persists, the greater the cancer risk. Chronic inflammation itself can be caused by many factors, including exposure to environmental toxins, infections, poor diet, and obesity.

From what we know so far, we can see that certain chronic inflammatory conditions can increase the risk of related cancers.

- Exposure to the toxin asbestos can lead to mesothelioma, a type of lung cancer
- Chronic bronchitis (often caused by smoking) can lead to lung cancer
- Gingivitis (gum disease) can lead to oral cancer
- Inflammatory bowel disease can lead to colon cancer
- Skin inflammation (frequent burns) can lead to melanoma, the most dangerous type of skin cancer
- Bladder inflammation can lead to bladder cancer
- Chronic pancreatitis (inflamed pancreas) can lead to pancreatic cancer
- Gastroesophageal reflux disease (GERD) can lead to esophageal cancer
- Chronic gall bladder inflammation can lead to gall bladder cancer
- Hepatitis (liver inflammation) can lead to liver cancer
- AIDS (blood infection) can lead to Non-Hodgkin's lymphoma
- Pelvic inflammatory disease can lead to ovarian cancer
- *Helicobacter pylori* infection (ulcer) is the leading cause of stomach cancer

We also know that healthy lifestyle factors can have a significant impact on cancer risk and cancer survival. In a 2020 study involving over 1,000 breast cancer survivors, researchers found that those who consumed an anti-inflammatory diet had better survival rates than those who did not.

In a 2019 study involving over 100,000 participants, researchers found that those who consumed a more anti-inflammatory diet had a reduced risk of cancer, including a reduced risk of lung and stomach cancer in men.

We'll talk more about what an anti-inflammatory diet is in a future chapter.

Chapter 7

Inflammation as a Cause and Driver of Type 2 Diabetes

You know that diabetes is a disorder affecting the blood sugar levels in your body. Consistent high blood sugar levels can indicate diabetes. Treatment always involves bringing those blood sugar levels down.

But recently, research has suggested that inflammation also plays a key role in both type 1 and type 2 diabetes. In a 2019 study, scientists suggested doctors target inflammation as well as blood sugar when trying to improve the prevention and control of the disease.

What Is Diabetes?

Before we dive into how inflammation and diabetes are related, let's quickly review what diabetes is.

According to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), diabetes is a disease “that occurs when your blood glucose, also called blood sugar, is too high.”

When you eat food, your body breaks it down into smaller, digestible components. Much of the food you eat is broken down into a type of sugar called glucose and released into your bloodstream. Glucose is the body's preferred type of fuel. It uses glucose to give you the energy you need to go about your day.



After you eat a meal and your body breaks it down into glucose, your blood sugar levels naturally go up. This signals your pancreas to release a hormone called insulin. Insulin acts like a key to “open the door” for sugar to enter into your body's cells. Then your cells take in the glucose and use it for energy.

Those with diabetes typically suffer from one of the following problems:

- **The body doesn't make enough insulin.** Without insulin to usher glucose into the cells, the glucose is left circulating in the blood. This spikes blood sugar levels.
- **The cells aren't responding to the insulin.** The insulin is trying to do its job, but the cells aren't responding. They keep their “doors” closed, refusing to let the glucose in. So, the glucose builds up in the bloodstream. This is also called “insulin resistance.”

There are two main types of diabetes:

1. **Type 1 diabetes:** This is thought to be an autoimmune disease, where the immune system malfunctions, attacks the body by mistake and stops it from making insulin. Only about 5-10 percent of people with diabetes have this type. It's usually diagnosed at a young age.
2. **Type 2 diabetes:** With this disease, the body doesn't make or use insulin well. People may develop this disease at any age, but it's most common in middle-aged and older people. This is the most common type of diabetes.

The Centers for Disease Control and Prevention (CDC) states that about 37.3 million people have diabetes (11.3 percent of the U.S. population), but that 8.5 million don't know they have it yet.

In addition, about 96 million people have prediabetes (38 percent of the population). This is a condition in which blood sugar levels are higher than normal, but not yet high enough to be diagnosed as type 2 diabetes. It is considered a risk factor for type 2 diabetes.

Scientists Find that Inflammation Plays a Key Role in Diabetes

The idea that inflammation could play a key role in diabetes has been around for a couple of decades now.



In a 2009 study, scientists noted that "recent studies suggest an inflammatory process" may be driving insulin resistance in type 2 diabetes.

In a 2011 study, researchers acknowledged that low-grade inflammation "is a common feature in subjects with type 2 diabetes." They added that heart disease, metabolic syndrome, and type 2 diabetes all have in common higher levels of circulating inflammatory cells in the bloodstream.

Later, scientists reported that inflammation may play a dual role in type 2 diabetes. First, it may help promote insulin resistance. Second, when blood glucose levels rise, inflammation does too, contributing to complications like heart disease.

For one study, scientists followed people with inflammatory disorders like Crohn's disease, severe psoriasis, and inflammatory arthritis. These people all suffered from chronic inflammation. They compared them to people without inflammatory disorders and found that those with more inflammation were more likely to be diagnosed with type 2 diabetes.

In a similar experiment involving over 6,000 people, scientists again found that those who did develop diabetes later in life were more likely to have higher levels of inflammation in their bodies.

Year after year, the evidence has accumulated, showing a clear connection between inflammation and diabetes. But scientists are still trying to figure out why these two conditions seem to always occur together.

Why Does Inflammation Show Up in Diabetes?

We know that high blood sugar levels damage blood vessels. It causes them to produce destructive free radicals, which generate oxidative stress and scar the lining inside your blood vessels.

This damage triggers the immune system to come roaring to the rescue. It creates inflammation with the intent to heal. Except that doesn't happen. Instead, it causes plaque to build up in your blood vessels, promotes blood vessel narrowing, and increases the risk of blood clots.

We also know that insulin resistance causes inflammation. When a person becomes insulin-resistant and the pancreatic cells no longer produce enough insulin to overcome the resistance, the body releases proteins that turn on inflammation.



Inflammation, in turn, interferes with insulin signaling, making insulin resistance worse. These two conditions work together, reinforcing each other and causing a downward spiral.

As to which develops first—inflammation or insulin resistance—scientists aren't sure. It could be that insulin resistance starts and then incites inflammation. Or it could be that inflammation already existing in the body interferes with insulin and creates insulin resistance. Both may also occur at the same time.

Obesity Leads to Inflammation Leads to Diabetes

One of the reasons scientists began looking into the connection between inflammation and diabetes is that cases of newly diagnosed diabetes have been increasing. The CDC notes that between 2002 and 2015, the rate of new cases increased in all age, sex, and race/ethnicity groups.

Why more people are developing type 2 diabetes is unclear. Many scientists believe that it is tied to the increase in overweight and obesity. The CDC states that between 2017 and 2018, over a third of Americans (42.4 percent) were obese. From 1999-2000 to 2017-2018, the incidence of obesity increased from 30.5 percent to 42.4 percent.

Obesity is defined as having a body mass index (BMI) of 30 or more. It is considered a primary risk factor for the disease, and also causes the disease to worsen faster.



Of course, type 2 diabetes can develop in patients of normal weight. But most scientists agree that obesity is the driving force behind the increase in cases. The Cleveland Clinic notes that if you are obese, you're about six times more likely to develop type 2 diabetes than someone with a normal weight.

This is mainly because fat cells are known to cause inflammation all by themselves. Abdominal fat, in particular, secretes large quantities of pro-inflammatory chemicals.

Plus overeating stresses the body. By now, you know what that means—the immune system stimulates inflammation to solve the problem.

In a 2014 study out of the University of Oslo, researchers found that overeating increases the immune response. When fatty acids accumulate in the cells, they begin to send out damage signals, calling on the immune system for help. Over the long-term, this low-level damage and inflammation can, in turn, cause insulin sensitivity, leading to type 2 diabetes.

In a more recent article published in *Cell Metabolism*, scientists noted that the accumulation of an excessive amount of body fat can cause type 2 diabetes. They added that the risk increases right in line with how much weight increases. In other words, the more weight you gain, the more your risk for type 2 diabetes goes up.

They went on to report that adipose (fat) tissue produces pro-inflammatory cells that cause insulin resistance, and that this sort of inflammation-driven insulin resistance may be a "major driver" of the disease in obese people.

Based on these studies and more, we can see that inflammation may contribute to the development of type 2 diabetes in the first place, and then may make it worse once you have it.

Healthy Lifestyle Habits May Help Reduce the Risk of Diabetes and Slow Its Progress

We still have more to learn when it comes to how inflammation and diabetes are related. What's important is to realize the two almost always exist together. With that knowledge, you can take steps to both prevent the development of diabetes and help slow the disease progression after you are diagnosed.

Reducing inflammation in your body through healthy lifestyle habits, for example, may help you avoid developing diabetes in the first place. If you already have it, doing your best to control and reduce inflammation could help reduce your risk of diabetes-



related diseases like the following:

- Heart disease and heart attack
- Stroke
- Kidney disease
- Neuropathy
- Blindness
- Lower-extremity amputation
- Dementia
- Skin problems
- Hearing impairment
- Depression

Chapter 8

Where the Immune System Goes Wrong in Autoimmune Diseases



Rheumatoid arthritis, Lupus, Crohn's disease, multiple sclerosis (MS), type 1 diabetes, and thyroid diseases are all examples of autoimmune diseases. They all involve some sort of malfunction in the immune system. And as with heart disease, cancer, and diabetes, they all are closely associated with inflammation too.

The relationship between inflammation and autoimmune disease is unclear, though. Does the disease trigger the inflammation, or is it the other way around?

And once it gets going, why doesn't it stop?

Scientists are trying to answer these questions. In this chapter, we'll examine what we know so far.

What Are Autoimmune Diseases?

Autoimmune diseases occur when the immune system mistakenly attacks the body. It sees the body's own tissues as invaders that must be neutralized. Scientists don't know why the immune system gets away with this in some people. But once it does, it damages the body's tissues, causing symptoms and often degenerative conditions that don't heal.

It's not entirely unusual for an immune cell to mess up and attack the wrong thing. It happens now and then even in healthy people. That's why the body is prepared to identify and destroy malfunctioning immune cells when it needs to.

Autoimmune disease occurs when a *lot* of cells begin to malfunction like this—way more than normal. The immune system's policing effort doesn't work like it should, so the self-attacking cells escape destruction and go on to attract more self-attacking cells. Soon there are enough of them to cause significant damage.

What triggers this outcome is unclear, but scientists believe that viral infections and hormones are among the top two potential suspects. They also have evidence that genes and environmental factors may be involved.



As these rogue cells gain numbers, they instruct other immune cells to attack the body's own tissues. This creates inflammation which in turn, creates symptoms like swelling, tissue damage, and destruction.

There are many different types of autoimmune diseases. They are characterized by what parts of the body they affect. Doctors put them into two broad categories:

1. **Organ-specific:** The immune system attacks just one organ or one type of bodily tissue.
2. **Non-organ-specific:** The immune system attacks more than one organ—multiple organs or body systems may be affected.

Some autoimmune disorders create only mild to moderate symptoms, while others are more severe to the point of being disabling. There is generally no cure, so doctors focus on managing symptoms.

Types of Autoimmune Diseases

There are about 100 different types of autoimmune diseases. Listed below are some of the most common.

- **Diabetes (type 1):** The immune system attacks the pancreas, preventing it from creating the insulin needed to process blood sugar. Blood sugar levels rise.
- **Grave's disease:** The immune system attacks the thyroid gland, affecting its ability to produce needed hormones.
- **Inflammatory bowel disease:** Crohn's disease and ulcerative colitis are both types of inflammatory bowel diseases. The immune system attacks the intestines, creating inflammation and causing damage.
- **Multiple sclerosis:** The immune system attacks the nerves, causing numbness, paralysis, and vision impairment.
- **Psoriasis:** The immune system attacks the skin, creating thick, reddened scales.
- **Rheumatoid arthritis:** The immune system attacks the joints, with inflammation making them stiff, swollen, painful, and eventually, deformed.

- **Scleroderma:** The immune system attacks the skin and other similar tissues such as those in the joints, creating stiffening scar tissue.
- **Systemic lupus erythematosus:** The immune system attacks connective tissue throughout the body, causing joint inflammation, fever, weight loss, and a facial rash.

Innate vs. Adaptive Immunity

Scientists used to believe that with autoimmune diseases, the problem was with the immune cells alone. They thought these cells malfunctioned for some unknown reason and started the inflammatory process.

Recent evidence, however, suggests that inflammation may play a much greater role in both the onset of autoimmune disease and the type of damage it creates than we thought.

To understand this better, it helps to examine the immune system more closely. Scientists typically break it down into two different categories:

1. Innate Immunity

Also called genetic or natural immunity, this is the immunity you were born with. It's written in your genes, and it provides lifelong protection. It's made to fight off any foreign invader and responds rapidly to any specific type of antigen (toxin or other foreign substance).

A good example of innate immunity in action is when you see redness and swelling around a recent cut on your arm.



2. Adaptive Immunity

Also called acquired immunity, this is the immunity that you gain as you live in the world. The immune system “learns” about certain toxins that it must protect you from as you are exposed to them throughout your life.

When you were exposed to chickenpox, for instance, your immune system “learned” about this foreign invader, marshaled up a way to kill it, and got rid of it. From that point on, your immune system knows this virus and is prepared to defend you from it.

When you hear about vaccines and how they teach your immune system to fight a particular pathogen, that’s the adaptive immune system they’re talking about.

Autoinflammatory vs. Autoimmune Diseases and Immunity

Autoinflammatory diseases—inflammation-based diseases that create symptoms similar to autoimmune diseases—are considered disorders of innate immunity.

The innate immune system notices unusual bacteria in the intestines or small injuries to certain tissues and overreacts, stimulating chronic inflammation. This information then spreads throughout the body, causing a variety of symptoms like swollen lymph nodes and recurrent fever.

Autoinflammatory diseases are those like:

- **Familial Mediterranean Fever (FMF):** causes recurring bouts of fever
- **Neonatal Onset Multisystem Inflammatory Disease (NOMID):** causes inflammation of the skin, joints, eyes, and central nervous system in children
- **Tumor Necrosis Factor Receptor-Associated Periodic Syndrome (TRAPS):** causes inflammation on the skin, in and around the eyes, and throughout the body



Autoimmune diseases, on the other hand, are considered disorders of adaptive immunity. The adaptive immune system makes a mistake and determines that a cell that is part of the body itself ("self") is toxic or an invader ("other"). So, it forms antibodies to attack and destroy that type of cell.

This is why autoimmune diseases are often specific. The immune system attacks only certain types of "self" cells—such as those in the joints, nerves, or thyroid. Part of this attack involves inflammation.

Many Autoimmune Diseases Thought to Involve Both Types of Immunity

When we divide these diseases and the types of immunity they affect this way, it makes it easier to understand what might be going on. It's straightforward and organized.

But recently, scientists have noticed that it's not so clear-cut. It seems both types of immunity and both types of diseases interact more than we thought they did before.

Some diseases defined as autoimmune, for example, have been found to have primary autoinflammatory beginnings. And although autoimmune diseases are strongly related to adaptive immunity, it seems they may also have an innate immunity factor that scientists have only recently discovered.

Rheumatic diseases, for instance—like rheumatoid arthritis—are now classified as both autoimmune *and* autoinflammatory disorders. Lupus too, long classified as mainly an autoimmune disorder involving mostly the adaptive immune process, is now thought to involve innate immunity as well.



This is because the immune system itself is complicated, and its various cells are always interacting and communicating with one another. If something goes wrong in one part of the immune system, it can quickly translate into another part. Meanwhile, inflammation is one of the immune system's greatest tools, so it tends to come into play no matter what kind of immunity we're talking about.

Some researchers now believe that these two types of disorders—autoinflammatory and autoimmune—are not two separate things, but rather opposite ends of a spectrum, with many diseases featuring a mix of both innate and adaptive immune dysfunction.

Scientists Working on Treatments to Retrain the Immune System

No matter which comes first or which influences the other, inflammation is always involved in autoimmune diseases. It is the main process that causes damage to the body.

That's why many scientists are now focused on finding ways to tame a hyperactive immune system in those with autoimmune diseases. In 2017, Mark Peakman, a clinical immunologist at King's College in London, and his colleagues published the results of an early clinical trial. The scientists tested a treatment in those newly diagnosed with type 1 diabetes.

The scientists hoped the treatment would teach the immune system to stop attacking the pancreas. Six months after the initial diagnosis, most of the treated participants were still producing enough insulin to avoid increasing their use of supplemental insulin, unlike those on the placebo.

Treatments like these are in their early stages of study, but they do suggest that in the future, we may have tools we can use to train the immune system to tolerate the tissue it thinks it's supposed to attack.

Should we be able to do this, we can stop that chronic inflammation from taking hold, and protect the body's tissues and organs from being damaged and destroyed. Since autoimmune conditions are on the rise, particularly in women, this is a worthy goal.

Chapter 9

Is Inflammation the Key to Developing Dementia?

The U.S. Alzheimer’s Association (AA) reports that in 2022, an estimated 6.5 million Americans age 65 and older will be living with Alzheimer’s dementia. That’s about 1 in 9 people in that age group.

The Centers for Disease Control and Prevention (CDC) states that in 2060, the number of people affected by dementia in the U.S. is projected to be nearly 14 million.

Is dementia a normal part of aging? Research shows that it’s not. Many older adults live their entire lives without developing dementia.

Age is a risk factor for the disease, but it doesn’t cause dementia on its own. Instead, patients usually have other risk factors such as:



- A family history of the disease
- Poor heart health (high blood pressure and high cholesterol increase the risk of dementia if not treated properly)
- Smoking and excessive alcohol use
- Diabetes
- Traumatic brain injury
- Down syndrome

Recent research also suggests that inflammation may play a key role in causing dementia

Studies Find that Inflammation May Start and Worsen Dementia

In a 2020 study from the University of Cambridge, researchers noted that inflammation in the brain may be more widely implicated in dementia than was previously believed.

The scientists set out to examine whether inflammation may also occur in various forms of dementia. They recruited 31 patients with different types of dementia and performed brain scans to detect inflammation and so-called “junk proteins” that signal dementia.

The results showed that in all types of dementia studied, the more inflammation that existed in each part of the brain, the more harmful build-up of the junk proteins there was.

“We predicted the link between inflammation in the brain and the build-up of damaging proteins,” said Dr. Thomas Cope from the Department of Clinical Neurosciences at Cambridge, “but even we were surprised by how tightly these two problems mapped on to each other.” The scientists added that there may be a vicious circle where cell damage triggers inflammation, which in turn leads to further cell damage.

Sound familiar? It should, as this is how inflammation works throughout the body!



Many other studies have found similar results—that inflammation is strongly associated with dementia, no matter what type of dementia it is. In a 2018 review, scientists found that inflammation likely plays a role in the onset and the progression of Alzheimer’s disease.

They reviewed numerous studies showing that chronic inflammation in the brain accelerates the damage that leads to Alzheimer’s, and suggested treatments

that target this type of inflammation.

This makes sense, as we know that some people can have those amyloid brain plaques that are characteristic of Alzheimer’s disease in their brains, but not develop Alzheimer’s. In fact, when scientists first discovered the presence of these plaques in the brains of those with dementia, they focused on treatments that would eliminate them.

These treatments, however, have so far created only modest impacts on cognitive decline. They haven’t worked as well as scientists hoped they would. So, they’ve been forced to take a second look at what’s going on.

Recent studies have suggested that the key may be in targeting inflammation. We have evidence, for instance, that people with amyloid plaques in their brains that don’t develop dementia are typically lacking inflammation in the brain.

Scientists from the University of Pittsburgh School of Medicine conducted brain scans on 130 individuals—some who had been diagnosed with Alzheimer’s disease while others had not. They found that many of them had amyloid plaques in their brains, but that it was the presence of inflammation that led to widespread brain damage and cognitive impairment.

This is another example of the immune system trying to repair the body. It senses the presence of the plaques, and in some people, triggers inflammation to repair those areas in the brain that are affected. Should the inflammation become chronic, however, it can do the opposite—create more damage.

We have evidence this is the case. In a 2021 study, researchers found that inflammation in the brain caused more damage in those with Alzheimer’s disease, further exacerbating the cognitive effects.

Inflammation Elsewhere Can Increase the Risk of Inflammation in the Brain

Why would this chronic inflammation take hold in some people’s brains but not others?

This is still unclear. We do have evidence that inflammation elsewhere in the body—in those who have inflammatory bowel disease or rheumatoid arthritis, for example—can increase the risk of dementia in those same people.

Even depression—which can be driven by chronic inflammation—has been found to predispose people to Alzheimer’s later in life. We already have clinical evidence that depression is a common precursor to Alzheimer’s disease and may be an early manifestation of dementia. Researchers now believe that chronic low-grade inflammation could be at least part of the reason why.



Many of the genes identified as putting people at risk for Alzheimer’s are known to play roles in people’s immune functioning—including the aspects of immunity that regulate inflammation.

We also know that people who have higher levels of inflammation in midlife are more at risk for cognitive decline as they get older. In one 2019 study of over 12,000 people, researchers examined data concerning inflammation in midlife and later diagnosis of dementia.

They found that the more inflammation increased in midlife, the more likely people were to experience cognitive decline 20 years later. They also found an association between high C-reactive protein (CRP, which is an inflammatory marker) levels in midlife and later cognitive problems.

All told, people with a midlife inflammation composite score in the top quartile had a 7.8 percent steeper cognitive decline, compared to those in the lowest quartile. A CRP measurement in the top quartile was associated with an 11.6 percent steeper cognitive decline.

Lifestyle Habits that Cause Inflammation Can Increase the Risk of Dementia

In most people, there are likely several factors involved in causing dementia, including unhealthy lifestyles. In a recent 2021 study, for example, researchers noted that dementia is not an inevitable companion to old age, but seems to be more likely in those with certain lifestyle habits.

These may include:

- Not getting enough exercise
- being overweight
- eating a poor diet
- not getting enough sleep every night
- smoking
- consuming excess alcohol

Why would these lifestyle habits increase the risk of dementia? Again, we come back to inflammation. Unhealthy lifestyle habits like these are known to increase the risk of chronic inflammation.



In a 2021 study, for example, researchers found that what you eat is very important. Over 1,000 volunteers reported what foods they ate in the previous month in a questionnaire. Researchers used this information to determine the inflammatory potential of a person's diet. High scores showed a more inflammatory diet. They then split the volunteers into three groups:

1. Those with the lowest scores
2. Those with medium scores
3. Those with high scores

The researchers found that 62 of the volunteers who took part in the study later developed dementia. Compared to the volunteers who consumed the least inflammatory foods (with the lowest scores), those who had the highest scores were about three times more likely to develop dementia.

In a 2021 review, researchers focused on three lifestyle factors that negatively affect cognition:

- Obesity
- Sedentary behavior
- Insufficient sleep

They looked at each one and its impact on brain health, then explored *how* an unhealthy lifestyle may cause brain damage.



They found that all three lifestyles had one thing in common. You can probably guess by now what that was! Indeed, all of them caused brain damage by activating inflammation. This inflammation then damages the small blood vessels in the brain, to the point that dementia can develop.

The researchers also noted that the prevalence of these lifestyles in Western society is increasing. More people are overweight and obese, sedentary, and

struggling to get enough sleep every night.

Other unhealthy lifestyle habits—like smoking and excessive alcohol intake, which are associated with an increased risk of dementia—are also associated with chronic inflammation.

Might Anti-Inflammatory Drugs Help Prevent Alzheimer’s?

Does all this mean that anti-inflammatory drugs may be useful in treating or delaying dementia? Scientists have tried that, but so far, they’ve found mixed results.

This could be because the immune system is complicated, and it’s difficult to target the specific inflammatory marker that may be causing the problem. Simple over-the-counter anti-inflammatory drugs like aspirin, for instance, have not been effective so far.

But in a 2020 study, scientists found that the prescription anti-inflammatory drug, diclofenac, was associated with both reduced incidence and slower cognitive decline in Alzheimer’s disease.

Further research may help clarify things.

Meanwhile, scientists agree on one thing: adopting healthy lifestyle habits can help. In the review mentioned above, the scientists wrote that doing so “may be the only path to reducing dementia risk for the individual....”

Chapter 10

The Different Types of Inflammation Involved in Arthritis

Arthritis is a joint disorder in which the joints become painful, stiff, and damaged.

But what causes it to develop?

That depends. And based on what is causing the disease, we can better understand what role inflammation will play.

In this chapter, we examine the two main types of arthritis and how inflammation works in each.

Two Main Types of Arthritis

Though inflammation is a factor in all types of arthritis, it plays different roles depending on which type you may have.

In general, there are two categories of arthritis:

1. Osteoarthritis

In this type of arthritis, the smooth cartilage that serves as a shock absorber in the joint wears out. As it breaks down, the joint becomes stiff and painful. Inflammation takes root and exacerbates the breakdown until eventually, the joint is "bone-on-bone" with no cushioning in between.

This type of arthritis is caused by physical wear and tear over time. That's why doctors most commonly diagnose it in people over the age of 50. The symptoms and damage are limited to the joints themselves.



2. Inflammatory arthritis

Inflammatory types of arthritis are autoimmune diseases in which the immune system mistakenly attacks its own tissues. This creates chronic inflammation, which causes joint pain and stiffness.

Unlike osteoarthritis, inflammatory arthritis may cause symptoms in other parts of the body too. These symptoms may affect the lungs, heart, eyes, skin, and other organs. That's why inflammatory arthritis is often considered a "body-wide" or "systemic" autoimmune disease.

Since inflammatory arthritis is a chronic disease, it can affect people of all ages and can be diagnosed in patients as young as 20-30 years.

Both of these types of arthritis involve inflammation, but there are differences in when the inflammation takes hold and what sort of immune reaction drives the inflammation.

Different Types of Inflammatory Arthritis

Within the inflammatory arthritis category are several different subsets of arthritis.

Rheumatoid Arthritis

This is the most common type of inflammatory arthritis. It usually involves small joints in the hands and feet. The immune system attacks the lining of the joints and tendons (the synovium) causing inflammation, pain, and stiffness.

Psoriatic Arthritis

Psoriasis is a disease where the immune system causes red, scaly patches on the skin. It is an autoimmune disease in which the immune cells mistakenly attack the body's own tissues. This same disease can cause inflammation, pain, and swelling in the joints and sometimes in the spine.

Juvenile Idiopathic Arthritis (JIA)

This type of arthritis affects young people under the age of 16. The immune system attacks the joints and ligaments (tissues that connect bone to bone), creating inflammation, pain, swelling, and stiffness. Some types of JIA cause eye inflammation as well.

Ankylosing Spondylitis (AS)

Another autoimmune disease, AS affects primarily the spine and hip joints, breastbone, and large joints of the body. Over time, it can significantly affect the spine, making it stiff and inflexible. Up to half of the people with AS have a genetic marker for the disease.

Gout and Pseudogout

These forms of arthritis are caused by elevated levels of certain crystals in the body. Gout results from excess uric acid, a waste product found in the blood. Pseudogout occurs when calcium salts form in the joints, provoking inflammation most often in the wrists and knees.

In addition to these types of inflammatory arthritis are other forms of autoimmune diseases that may also cause joint pain. Lupus and Sjogren's syndrome are examples.



How Inflammation Damages Joints in Arthritis: Osteoarthritis

Whether you have osteoarthritis or inflammatory arthritis, you have inflammation in the joints. That inflammation behaves differently, however, depending on the type of disease.



With osteoarthritis, the body is dealing with a wear-and-tear injury and is responding accordingly. It sees the breakdown of cartilage as an injury and sends in the inflammatory cells to go to work repairing the damage.

Unfortunately, the process doesn't work perfectly. The immune system may succeed in repairing some of the cartilage tissue, but the continued presence of the damaged cartilage keeps the inflammation going longer than it should. This ongoing,

low-grade inflammation can destroy some of the cartilage, making the damage worse.

It used to be that scientists thought inflammation played only a small role in osteoarthritis, taking hold after the fact, so to speak. Recent research, however, has suggested that inflammation may have something to do with accelerating joint damage at a much earlier stage than was previously believed.

In a study review, for instance, scientists pinpointed many instances in which inflammation seemed to precede significant joint damage in those with osteoarthritis.

Obesity

We already know that obesity increases the risk of osteoarthritis. We used to think this was strictly because the excess weight put added pressure on the joints, causing them to wear out faster.

That remains true, but scientists have recently found that inflammation may have a lot to do with it too.

Some studies have found, for instance, that in individuals who are overweight or obese with low levels of inflammatory markers in the blood, joint damage is less severe than in those who have higher levels of inflammation.

On top of that, obese individuals are at a higher risk of joint disease in both weight-bearing *and* non-weight-bearing joints, suggesting that inflammation is what's driving the damage.

Aging

There are many factors often associated with aging that can increase the risk of higher inflammation levels.

Scientists know that there are clear interactions between the risk factors for osteoarthritis and the aging process. As inflammation takes hold in various parts of the body, it is more likely to harm the joints as well.

Osteoarthritis Involves Innate Immunity

Another difference between the inflammation in osteoarthritis and inflammatory arthritis is the type of immunity involved.

You may remember in Chapter 8 that we talked about innate (what you were born with) immunity and adaptive (how your immune system learns) immunity.

With osteoarthritis, it is innate immunity that is involved. The body's innate immune system responds to the joint injury and tries to fix it.



With inflammatory arthritis, on the other hand—as is the case with autoimmune disease—it is adaptive immunity that is involved.

How Inflammation Damages Joints in Arthritis: Inflammatory Arthritis

Another main difference between osteoarthritis and inflammatory arthritis is where the inflammation is.

In osteoarthritis, the inflammation is typically limited to the joints. It may exist elsewhere in the body—if the person is overweight or obese, for instance—but this other inflammation is not caused by the same disease. Osteoarthritis itself causes inflammation only in the joints.

Inflammatory arthritis, on the other hand, causes “systemic” or body-wide inflammation. It damages the joints but may also affect other organs. Patients show elevated inflammatory markers in their blood and are diagnosed with an autoimmune disease.

If you have inflammatory arthritis, joint degeneration is attributed almost entirely to the destructive nature of chronic inflammation. We’re not talking about wear and tear as is the case with osteoarthritis. Instead, the inflammation itself goes after the joint, irritating it and over time, wearing down the cartilage that before might have been perfectly fine.

Scientists aren't sure yet what triggers this type of arthritis to develop. They believe that it's a combination of environmental and genetic factors that activate the immune system in autoimmune diseases.



In rheumatoid arthritis, for instance, a variety of immune cells can be found in the lining and fluid of the joint. These cells attract other immune cells in and together they lead to a thickening of the joint lining, new blood vessel formation, and ultimately, joint damage.

In general, inflammation in these types of arthritis is much more severe than it is in osteoarthritis. Without treatment, it can progress much more quickly. The disease also tends to attack several joints at once, often on both sides of the body, whereas osteoarthritis may attack only one or two.

The systemic inflammation in inflammatory arthritis is also likely to cause other symptoms like fatigue, low fever, low

appetite, and the like.

Treating Inflammation in Arthritis

In both types of arthritis, reducing inflammation is important, but it is critical in inflammatory arthritis. Doctors are known to recommend an anti-inflammatory diet, regular exercise, and activities that help reduce stress.

As with the other diseases we've talked about, reducing overall inflammation may help reduce your risk of developing arthritis in the first place, and if you have it, may help slow down joint damage and degeneration. Healthy lifestyle habits can also help reduce pain and swelling and maintain mobility.

Current medications used to treat and osteoarthritis include inflammatory drugs like aspirin and steroids. Treatments for inflammatory arthritis also include more powerful anti-inflammatory medications like disease-modifying antirheumatic drugs (DMARDs). These work to suppress the body's overactive immune and inflammatory systems.

Chapter 11

Inflammation's Role in Skin Aging and Diseases

When it comes to skin problems, inflammation is at the core of pretty much any issue you may experience.

Redness, pain, itching, acne breakouts, eczema, psoriasis, rosacea, rashes—they all involve inflammation. What causes the inflammation may be different, though.

In this chapter, we look at the various ways that inflammation can negatively affect your skin.

Chronic Inflammatory Skin Conditions

You may remember that we've talked about the difference between acute and chronic inflammation.

Acute is short-term and fast. It shows up when you hurt yourself. Maybe you cut or scraped your skin, came into contact with something you're allergic to or suffered a sunburn. Acute inflammation revs up to help heal the damage. Once it's completed its job, it goes away.

Chronic inflammation is long-term and slow. Instead of healing the skin, it tends to damage it. The most common chronic inflammatory skin diseases include:

- Dermatitis (eczema)
- Rosacea
- Seborrheic dermatitis (dandruff)
- Psoriasis



Scientists believe that all of these conditions involve some sort of an immune overreaction. Like autoimmune diseases, they arise when the immune system malfunctions.

Let's look at each one more closely, and see how inflammation reacts with each.

Psoriasis

People with psoriasis have immune systems that mistakenly attack the body's skin cells. This causes the body to make new skin cells at a faster rate. These extra cells pile up on the surface of the skin, creating the plaques you see in psoriasis.

This process of producing excess skin cells involves inflammatory chemicals. They speed up cell growth and play a primary role in creating unsightly plaques. People with psoriasis often have higher levels than normal of inflammatory cells in their bloodstream too, showing body-wide inflammation. That's why psoriasis can lead to psoriatic arthritis, where the inflammation damages the joints.

Rosacea

Scientists believe that rosacea also develops because of an overactive immune system. Once you have it, environmental triggers like hot drinks and spicy foods can trigger flare-ups.



Like psoriasis, rosacea is a chronic inflammatory skin condition. But while psoriasis can show up pretty much anywhere, rosacea most commonly affects the face and eyes. Occasionally, the neck, chest, or other areas may be involved.

When environmental triggers are present, the immune system overreacts, inducing a signaling cascade of inflammatory factors that lead to chronic inflammation.

In other words, if you have rosacea and you go out into the sun, your immune system may overreact to the sun's rays, stimulating inflammation and causing that redness and swelling that you experience.

Dermatitis

Dermatitis is a general term used to describe inflammation. ("Derm" means "skin" and "itis" means "inflammation.") There are various types of dermatitis, including eczema, dandruff, skin rashes, and more. The location depends on the type. Seborrheic dermatitis affects the scalp, for instance, while periorificial dermatitis affects the eyes, mouth, and nostrils.

Scientists believe most cases of dermatitis are caused by a combination of an immune overreaction, genetics, and environmental triggers. As with rosacea, the skin overreacts when it comes into contact with an environmental trigger. The immune system panics and sends in inflammatory cells that create redness, flakiness, and rashes.

How Inflammation Differs in Chronic Inflammation Diseases

Interestingly, the type of inflammation involved in each of these diseases is usually different. Scientists have discovered this because a medication that may help tame inflammation in psoriasis often doesn't work to tame inflammation in dermatitis, and vice versa.

Biologic drugs that block the inflammatory cell TNF-alpha, for instance, don't work for patients with atopic dermatitis. By contrast, dupilumab (Dupixent) is very effective in atopic dermatitis, because it targets different types of inflammatory cells (IL-4 and IL-13).

This is why it can be challenging for scientists to find effective treatments for inflammatory skin conditions. All of them share inflammation as a key factor, but the type of inflammation—and what cells are driving it—can often be very different.



Scientists have also discovered a connection between levels of inflammation and skin barrier function. Your outermost layer of skin serves as a barrier between you and the world. It helps protect you from environmental assaults (pollution, UV rays, chemicals), and it also helps keep moisture trapped in your skin.

When this barrier is damaged, skin is more likely to react to environmental triggers. Inflammation is more common, and dryness, flakiness, redness, and swelling can result. We know that we can damage the skin barrier by not taking care of the skin—not protecting it from the sun, or not moisturizing it enough.

But now we also know that inflammatory cells can decrease the expression of genes known to shore up this outer barrier. That means that inflammation, in addition to causing rashes, redness, and plaques, can also damage the skin barrier, making the skin even more sensitive and reactive.

Inflammation and Other Skin Issues

Several other more common skin problems are also largely affected by inflammation.

Allergic Reactions

If you have allergies, they may affect your skin. Food, medications, and pollen can all trigger allergic reactions in your skin. When you're exposed to these substances, your immune system overreacts and sends cells to attack the invader. This results in inflammation, redness, hives, and swelling.

For these types of skin conditions, dermatologists typically recommend avoiding your allergic triggers and taking antihistamines to reduce allergic symptoms.

Acne

It used to be that scientists believed acne followed a clear process from bacteria to inflammation to pimples. When bacteria get into your pores, the immune system responds to get rid of it. It creates inflammation, which is why the pore becomes red and swollen. Over time, the inflammation kills off the bacteria, creating the pus inside the pimple as a waste product. Once the bacteria are gone, the pimple heals.



But today, scientists are looking into inflammation as being present from the very beginning—perhaps even before the pimple forms. Studies have suggested that acne may be *primarily* an inflammatory disease—partly because anti-inflammatory drugs have been found to be effective against it. We’ve also discovered that acne can develop in the absence of *P. acnes*, the bacteria that has been thought to be mainly responsible for acne.

Inflammation affects all types of acne, but it is even more destructive in severe acne, also called “inflammatory acne.” A person with this type of acne may have large, deep cysts that develop on the face, neck, chest, and back, and can leave scars behind.

Scientists are studying potential anti-inflammatory medications to see if they may help in the treatment of acne. Meanwhile, dermatologists recommend doing everything you can to reduce overall inflammation to reduce breakouts.

Aging

Chronic inflammation plays a key role in skin aging. The two are so connected that scientists often use a new term, “inflammaging,” to describe how inflammation can accelerate the aging process—not only for the skin but the entire body.

Persistent, underlying inflammation in the skin tends to ultimately exhaust the skin’s defense system. That weakens the skin structure, damaging the collagen and elastin that are responsible for keeping the skin firm and young-looking.

As these fibers are damaged, the skin begins to sag and droop. This is what causes fine lines and wrinkles, as well as the sagging around the jowls and over the eyes that often occurs with aging.

Inflammation, as we mentioned above, also impairs the skin's barrier function. That means the skin is less likely to hold onto moisture, which is why your skin may feel drier as you age. The skin becomes vulnerable to environmental assaults and may be more reactive to certain allergens, chemicals, and more.

Some of the results of inflammaging in the skin include the following:

- **Dehydration:** The skin has a harder time keeping itself well-lubricated. Lacking sufficient water content, it becomes dry, dehydrated, and inflexible. This creates dryness, dullness, and uneven skin tone.
- **Sagging:** Chronic inflammation damages the skin's fibers, breaking down collagen and elastin at a rapid rate—outpacing the skin's ability to repair these fibers. The skin loses firmness and elasticity.
- **Glycation:** When you're young, your skin has many fat cells that help your skin look plump and smooth. Inflammation contributes to the degeneration of these fatty cells, creating advanced glycation end products (AGEs) that cause these cells to become misshapen. The face loses volume and begins to appear flat and sunken.



Can Skin Inflammation Travel to the Rest of the Body?

Until recently, scientists didn't think that inflammation in the skin could contribute to inflammation throughout the body—and certainly not to inflammatory diseases in the body.

But recent studies have suggested that skin inflammation may do just that. Studies involving people with psoriasis and dermatitis, for instance, have shown that the inflammation in the skin from these diseases likely increases the risk of heart disease.

In one interesting study, for example, researchers had older adults between the ages of 58 and 95 apply a skin cream all over their bodies for 30 days. Then they measured blood levels of three types of inflammatory cells.

The results showed that using the cream reduced the amount of all three of these inflammatory cells compared to the participants' levels before using the cream. In addition, using the cream lowered their levels to be nearly the same as those in their 30s.

This kind of research suggests that anything we can do to reduce inflammation in our bodies may not only benefit us internally but externally as well, in the appearance of our skin.

Chapter 12

How Do We Treat Inflammation?

How inflammation is treated varies depending on whether we're talking about acute or chronic inflammation. Treatment for acute inflammation focuses on reducing swelling and pain and helping the wound to heal as quickly as possible.

Treatments for chronic inflammation focus on reducing body-wide levels of inflammation and include anti-inflammatory lifestyle habits as well as medications.

Treatment for Acute Inflammation

With acute inflammation, treatment typically focuses on helping to soothe and reduce the swelling and



pain. This type of inflammation shows up when you hurt yourself. Maybe you sprained your ankle, cut your finger, or collided with the door frame and bruised yourself.

Though this type of inflammation is an important part of the body's response to an injury, it can also make it take longer for the injury to heal. Addressing the inflammation can help the tissues to heal and regenerate more quickly, meaning you'll feel better faster.

The most common treatment regimen involves these steps:

Rest

Rest the wounded area. This is particularly important for strained and sprained muscles and tendons. If you try to use them too soon after injuring them, you can cause further damage and increase the inflammation.

Ice

Ice is often recommended to help reduce inflammation and ease the pain of an injury. Doctors assume the ice helps bring the swelling down, but there is some debate as to whether that's really true.

In a 2017 study, scientists found that there was no difference in inflammation between athletes who used ice to recover from intense exercise and those who didn't. Still, many people do find that ice is helpful.

Wound Care

If you cut yourself or are dealing with an open wound of some sort, proper wound care—cleaning, disinfecting, protecting—can help the wound heal faster while reducing the inflammatory reaction.

Compression

To help treat inflammation and pain in joints, doctors will often recommend using a compression bandage around the joint. This can help support the joint while encouraging improved blood flow around the area.



Elevation

Resting the joint or wounded area higher than your heart can help to direct the blood and fluids away from it, reducing swelling and the effects of inflammation.

Non-steroidal Anti-inflammatory Drugs (NSAIDs)

Aspirin, ibuprofen, and naproxen are all over-the-counter anti-inflammatory drugs that help reduce inflammation and swelling. If the swelling and inflammation are severe, doctors can prescribe stronger anti-inflammatories.

Corticosteroid Injections

These inject anti-inflammatory medications into a specific place in the body—usually into a painful, swollen joint. They reduce inflammation and help ease pain and stiffness.

Treatment for Chronic Inflammation

Lifestyle changes can be very effective at reducing the effects of this type of inflammation. We will go over those below. But first, let's look at the types of medications and medical treatments doctors may use to help address the issue.

Many of these can have side effects when used long-term. Patients can discuss the advantages and disadvantages with their doctors.

NSAIDs

As mentioned above, these medications are designed to reduce inflammation. Your doctor may prescribe a daily NSAID to keep your levels of chronic inflammation down.

These medications work by blocking a specific enzyme that the body uses to make inflammatory compounds. That means the body produces less of them, which can help reduce inflammation and the associated pain.

Though these are very safe when taken short-term, long-term ingestion can increase the risk of stomach bleeding, kidney problems, and heart attack.

Corticosteroids

These drugs—including cortisone, hydrocortisone, and prednisone—suppress inflammation. They can reduce the signs and symptoms of inflammatory conditions like arthritis, asthma, and skin rashes.

Side effects of these drugs may include fluid retention, high blood pressure, mood swings, and weight gain. When used long-term, they can increase the risk of glaucoma, cataracts, high blood sugar, osteoporosis, thin skin, and common infections (cold, flu).



Immunosuppressants

Medications that stop your immune system from damaging your healthy cells and tissues are called immunosuppressants. Doctors often prescribe these to treat autoimmune conditions like rheumatoid arthritis and lupus.

You may remember that in autoimmune conditions, the immune system mistakenly attacks the body's own cells. This stimulates chronic inflammation, which damages cells, tissues, and joints. Immunosuppressants keep your immune system in check, helping to prevent cell damage and inflammation.

Conditions that benefit from immunosuppressants include lupus, multiple sclerosis, inflammatory bowel disease, psoriasis, and rheumatoid arthritis. These drugs include the corticosteroids mentioned above, as well as the following:

- Biologics (adalimumab and infliximab)
- Calcineurin inhibitors (tracrolimus and cyclosporine)
- Janus kinase inhibitors (tofacitinib)
- Monoclonal antibodies (basiliximab)

Possible side effects of these medications include:

- Increased risk of infection (cold, flu, pneumonia)
- Nausea and vomiting
- Increased hair growth
- Hand trembling

Long-term use of these drugs may increase the risk of other side effects including weight gain, cardiovascular disease, and cancer.

Infusion Treatments

Infusion treatments deliver medications intravenously (via an IV). If traditional drug therapy doesn't help to reduce the inflammation and tame the symptoms, doctors may recommend infusion therapy.



To receive this type of treatment, patients go to a doctor's appointment, sit in a chair, and relax while registered nurses administer the medications. Patients usually return for the treatment regularly, from once a week to once a month or less, often depending on the treatment and the condition treated.

Patients with rheumatoid arthritis, gout, inflammatory bowel disease, lupus, and gout often experience good results with this type of treatment. The infusions usually include a combination of

medications that help target the part of the immune system that is driving the inflammation.

Lifestyle Methods of Reducing Chronic Inflammation

Anyone who is living with chronic inflammation—or anyone who wants to prevent it—can benefit from certain lifestyle habits.

Stay Active

Several studies have indicated a link between physical activity and lower levels of inflammation. The more you can move around and exercise, the better, particularly as you get older.

In one study of over 3,600 healthy men and women over the age of 40, scientists found that more frequent physical activity was associated with lower odds of having elevated inflammation levels. In a similar study of over 4,200 men and women with a mean age of 49.2 years, regular physical activity was associated with lower levels of inflammation over 10 years of follow-up.

Researchers from the University of California San Diego School of Medicine found that just one session of moderate exercise (for 20 minutes) could act as an anti-inflammatory.

Eat Healthy Foods

We'll discuss the best anti-inflammatory diet in a future chapter, but for now, understand that what you eat can make a big difference in how much inflammation you have in your body.

Research has shown that the Mediterranean diet is great at reducing inflammation. It includes lots of fruits and vegetables, plus healthy fats in fish, nuts, and olive oil.

Just as some foods help lower inflammation, others are known to increase it. These include highly processed foods, and those high in sugar and saturated fats. Overeating, as well, has been linked with systemic inflammation.



Reduce Stress

Research shows that stress can cause inflammation in the body, and may promote the development of many chronic health conditions.

In a 2017 study, researchers reported that our modern lifestyle has increased chronic stress—the type of stress that doesn't go away. They added that stress induces inflammation, either starting diseases like cardiovascular disease or making them worse.

When you experience stress, the immune system responds with inflammation. Even if there is no bacteria or injury to address, this is still the way the immune system reacts. When stress is chronic or ongoing, inflammatory cells decide they need to stick around all the time. This leads to chronic inflammation.

If you already have an inflammatory condition, such as rheumatoid arthritis, and you suffer from chronic stress, that stress will release more inflammatory chemicals, increasing the overall inflammation in your body. This will make your arthritis symptoms worse and may lead to other medical issues as well, including heart attack or even cancer.

Lifestyle habits that regularly relieve stress can help interrupt this process. Good options include the following:

- Journaling
- Meditating
- Yoga and tai chi
- Regular exercise
- Deep breathing exercises
- Art and music therapy
- Time outdoors surrounded by nature
- Spending time with a loved one or a pet
- Massage
- Relaxing, hot baths
- Aromatherapy (lavender, lemon balm, and other calming scents)



Control Your Blood Sugar

Whenever you eat a lot of carbohydrates—white bread, sweetened cereals, pastries, cookies, white rice, refined sugar, and foods with high fructose corn syrup—you spike your blood sugar levels. Foods that raise your blood sugar levels, in turn, have been associated with elevated levels of inflammatory cells.

As we mentioned in chapter 7, insulin resistance and high blood sugar are inflammatory processes. Without treatment, repeated levels of high blood sugar can cause damage to the blood vessels, which will stimulate inflammation to fix the problem. High blood sugar also leads to weight gain, and we know that excess fat stimulates inflammation.

Eat a healthy diet rich in complex carbohydrates. These are whole-grain foods that have not been stripped of their fiber. Look for whole-grain flour and grains, and foods made with these ingredients.

Then make sure to regularly check your blood sugar levels to be sure they are healthy. If they start to get high, addressing the issue will help keep them under control, which can help reduce inflammation.

Don't Smoke

Smoking is known to increase inflammation, so if you smoke, do your best to quit. Smoking directly activates immune cells in your mouth and your airways to induce the secretion of pro-inflammatory factors.

In a 2020 study, researchers found that heavy smokers had significantly higher levels of C-reactive protein (CRP) and other inflammatory cells in their blood.

Get 7-8 Hours of Sleep Per Night

Several studies have reported an association between poor sleep and inflammation. In one study, researchers found that even just one night of sleep deprivation increased levels of pro-inflammatory markers in the blood.



Scientists believe this connection may explain why those who are sleep deprived are more likely to develop cardiovascular disease and diabetes.

The problem is that when you sleep, blood pressure drops and blood vessels relax. When you don't get enough sleep, blood pressure doesn't decline as it should, which could trigger cells in the blood vessel walls that

activate inflammation. A lack of sleep is also known to put the body under stress, and as you learned above, stress stimulates inflammation.

Chapter 13

11 Supplements That Have Powerful Anti-Inflammatory Properties

Studies have shown that several natural substances like extracts and spices have powerful anti-inflammatory properties. As we age, it can be helpful to combine some supplements with our healthy lifestyle habits to keep inflammation under control. Some of the supplements in this chapter may also be used as part of a treatment regimen for an inflammatory health condition. Always check with your doctor before adding one to your daily routine.

1. Curcumin

Turmeric is a flowering plant from the ginger family, and its root makes a spice that is the major ingredient in curry powder.

Curcumin is a compound within turmeric that has powerful anti-inflammatory properties. Several studies have shown that it reduces inflammatory markers when given to people with chronic inflammation. In one study, scientists reported that curcumin can suppress pro-inflammatory pathways related to most chronic diseases and block the production of certain inflammatory cells.

How Much? Studies typically use doses of 500-2,000 mg per day. High doses are not recommended long-term.



2. Omega-3 Fatty Acids (Fish Oil)

These types of fatty acids are abundant in fatty fish like salmon, cod, and mackerel. They help fight various types of inflammation and have been extensively studied for their potential to help reduce the risk of heart disease.

The most common omega-3 supplement is fish oil, which contains both eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). In one small study involving 250 people with degenerative disc disease, over half (59 percent) were able to substitute fish oil for nonsteroidal anti-inflammatory drugs (NSAIDs). Since fish oil has far fewer side effects, this is a promising finding.

How Much: Generally, up to 3,000 mg of fish oil daily is considered safe for adults.

3. Ginger

You may already know about ginger’s ability to relieve nausea and vomiting. Like its cousin turmeric, it also contains several active ingredients that reduce inflammation.



Two components in particular—gingerol and zingerone—may help reduce inflammation found in type 2 diabetes, kidney disease, and cancer. In a 2015 review, researchers added that it could help in the treatment of fatty liver, asthma, and arthritis through its anti-inflammatory actions, as well as its powerful activity as an antioxidant.

And in a 2017 review, researchers collected several studies providing “compelling evidence for ginger’s anti-inflammatory properties and potential use as a treatment for a variety of inflammatory diseases...”

How Much? Most experts recommend a dose of 1-4 grams (1,000-4,000 mg) daily of ginger powder, tablets, or fresh-cut ginger.

The maximum recommended dose is 4 grams. Ginger can act as a blood thinner, so use caution if you’re already taking blood thinners.

4. Boswellia

This is a tree that is found in parts of the Middle East, Africa, and India. Also called Indian frankincense, it’s made from the gum resin of the tree bark.

This supplement was used traditionally to treat various chronic inflammatory diseases. It is known to help reduce inflammation and pain and is often used to help treat arthritis pain. In a 2011 study, researchers found that several of the compounds in Boswellia inhibited pro-inflammatory enzymes.

Clinical trials have also shown that the extract not only has anti-inflammatory and anti-arthritis properties (it seems to protect cartilage from further destruction) but also improves pain and physical function.

How Much? A common dose is 300-500 mg three times a day for inflammatory pain.

5. Resveratrol

A powerful antioxidant found in grapes, blueberries, and other fruits with purple skins, resveratrol has been widely studied for its anti-inflammatory properties. So far it seems like it is helpful in diseases like fatty liver, ulcerative colitis, heart disease, and obesity.

If you are overweight, this may be a good supplement to take. Studies have shown that it lowers inflammatory markers as well as blood sugar in people with obesity. In one 30-day study, scientists found

that 30 days of resveratrol supplementation created metabolic changes in obese participants that were similar to the effects of dieting.

How Much? The typical dose is 150-500 mg per day. This supplement also has blood-thinning properties so use with caution.

6. Green Tea

Green tea is good for you for many reasons. It's a powerful antioxidant, for one, that may help protect brain function and heart health. It may also help control blood sugar levels and maintain a healthy weight.

Recent research has also found that green tea has anti-inflammatory actions. In a 2017 study, scientists found evidence that the compounds in green tea blocked inflammatory responses, and inhibited the release of pro-inflammatory markers.

In a more recent study, scientists found that green tea polyphenols improved inflammatory bowel disease, contributing to the management of inflammatory colitis.



How Much? The recommended dose of green tea extract is 250-500 mg per day. That's about the same as you'll get from 3-5 cups of green tea.

7. Cat's Claw

This herb comes from various *Uncaria* plants, which are woody vines that grow in the Amazon rainforest and other tropical areas of Central and South America.

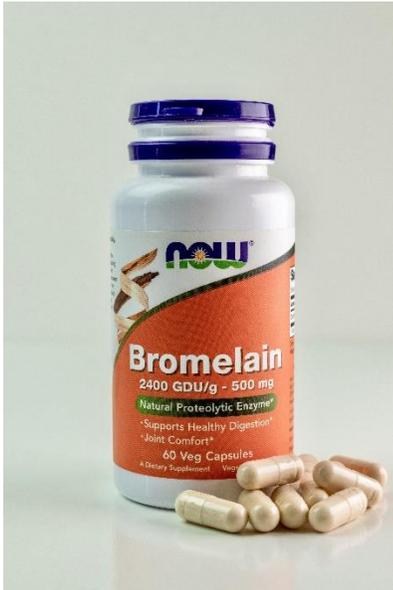
Though this one has not been as thoroughly tested as many of the others listed here, research suggests that it may reduce various forms of inflammation. It directly inhibits the production of one particular inflammatory marker (TNF-alpha) by up to 65-85 percent. It also inhibits the expression of some genes associated with inflammation.

Some studies suggest that cat's claw can help reduce the symptoms of arthritis. In one small study involving 40 people with rheumatoid arthritis, 60 mg of cat's claw per day alongside regular medication resulted in a 29 percent reduction in the number of painful joints compared to a control group.

Keep in mind that we need more studies on this one. Talk to your doctor about it.

How Much? Studies have used daily doses of 60-100 mg of cat's claw extract per day to treat arthritis. The World Health Organization (WHO) says the average daily dose is 300-500 mg for capsules, taken in 2-3 separate doses throughout the day.

8. Bromelain



A powerful enzyme found in pineapple, bromelain seems to have strong anti-inflammatory properties. Several studies of bromelain and cancer have found that it diminishes cell damage and interferes with cancer cell growth partially due to its effects on inflammation.

Bromelain may also reduce swelling, bruising, healing time, and pain after physical injuries and surgery. Some studies have shown that it equals non-steroidal anti-inflammatory drugs as an anti-inflammatory agent, but with fewer side effects. It's frequently used to reduce inflammation from tendonitis, sprains and strains, and other minor muscle injuries, and may help reduce pain in those with arthritis.

It can also be used topically to help treat wounds and burns.

How Much? Doses range from 80-400 mg per serving, two to three times daily.

9. Quercetin

This is a flavonoid (plant chemical) found in many fruits and vegetables, including apples, onions, and berries. It hit the news during the COVID-19 pandemic because it seemed to help reduce the inflammatory cascade in those with the virus.

Quercetin blocks pro-inflammatory chemicals like leukotrienes and prostaglandins. Like resveratrol, it has shown to be effective at reducing inflammation in people who are obese and also has anti-inflammatory effects in those with insulin resistance, atherosclerosis, and gut inflammation.

Quercetin has also shown potential in rheumatoid arthritis, inflammatory bowel disease, multiple sclerosis, and other autoimmune diseases. Scientists think this is because of its anti-inflammation and antioxidant properties.

How Much? The maximum dose is up to 1 gram (1,000 mg) per day. The most common dose is 500 mg per day.

10. Capsaicin

A compound found in peppers, capsaicin has been found to help ease muscular and nerve pain in the body. Substance P, a key component of capsaicin, may help reduce the body’s ability to feel and transmit pain.

In one laboratory study, researchers analyzed the effects of capsaicin on inflammation in the muscle cells. They found that it was very effective, and concluded that supplementation with the extract “may help to alleviate/reduce the inflammatory effects” in muscle pain and muscle diseases.

Other studies have found capsaicin to be effective against arthritis, gastrointestinal disorders, neuropathic (nerve) pain, and cancer.

How Much? Studies suggest 2-6 mg of capsaicin for pain and inflammation relief. Most supplements on the market contain cayenne pepper as the main ingredient as it is usually high in capsaicin. Two to five 500 mg cayenne pepper capsules should provide the proper amount. (Cayenne pepper usually contains about 2.5 mg of capsaicin per gram.) You can also use a capsaicin cream topically on the affected area.



11. Garlic

Garlic, like ginger, is a common food that’s rich in anti-inflammatory compounds. It’s particularly high in one called allicin, but there are others as well.

From the research we have so far, garlic seems to enhance the function of the immune system by stimulating certain cell types and reducing inflammation when needed. It performs a variety of activities found to help reduce the risk of cancer, reduce inflammation in obese adults, and even reduce the risk of inflammation-related diseases.

More specifically, it inhibits mediators of the inflammatory response, including cytokines, chemokines, and more. In a 2019 study, scientists suggested it as possibly preventing many age-related diseases because of its anti-inflammatory, antioxidant, anticancer, and cardioprotective properties.

How Much? Suggested doses are:

- 2-5 grams of raw fresh garlic
- 0.4 to 1.2 grams of dried garlic powder
- 2-5 mg of garlic oil
- 300-1,000 mg of garlic extract

Chapter 14

7 Foods to Avoid on An Anti-Inflammatory Diet

What you eat can have a significant effect on the inflammation levels in your body.

Scientists have found that Western-type dietary patterns that are high in processed meats, saturated fat, refined sugars, salt, and white flour while being low in fiber, nutrients, and phytochemicals are associated with higher levels of inflammation.

These diets also tend to be high in calories and involve many high-glycemic items that spike blood sugar levels. This can lead to insulin resistance and weight gain, which in turn, increase inflammation levels.

In this chapter, we'll review some of the biggest offenders when it comes to increasing inflammation in the body. These are the foods you want to limit or avoid completely if you can.

1. Added Sugar



The Western diet includes too much sugar. According to the American Heart Association (AHA), American adults consume an average of 77 grams of sugar per day—more than three times the recommended amount for women. This adds up to around 60 pounds of added sugar per year.

The AHA recommends that men consume no more than 9 teaspoons of added sugar per day, and women no more than 6 teaspoons. Considering one 12-oz. can of soda contains 8 teaspoons, you can see

how quickly that adds up.

Human studies have linked a higher intake of sugar with higher levels of inflammation. In one small study, researchers found that participants consuming 40 grams (9.5 teaspoons) of added sugar per day experienced an increase in inflammatory markers, insulin resistance, and LDL cholesterol.

Other studies have found similar results. In addition, sugar is known to increase the risk of overweight and obesity, which in turn, increases inflammation.

Action: Limit the amount of added sugar you consume every day. Sugar in fruit is considered healthier because it comes with fiber. But sugar in fruit juice, soda, sugary treats, and baked goods will add to your waistline and your inflammation.

2. Highly Processed Foods

Foods that are highly processed are those that are furthest from their natural state. These are boxed, bagged, and packaged foods that have been put through multiple processes to create what you eventually eat.

They've been heated, blanched, cooked, canned, dried, dehydrated, mixed, and combined with preservatives and other additives to increase their shelf-life and make them more convenient to prepare. Examples include frozen pizza, cookies, sugary drinks, deli meats, chips, most breakfast cereals, and cake mixes.



There are some healthy processed foods. These are the ones that have undergone limited processing and include frozen and canned whole fruits and vegetables, washed and bagged lettuce and spinach, tuna and salmon in cans, and packages of nuts.

Unhealthy processed foods are those that have been highly or heavily processed to the point where they contain few nutrients and little-to-no fiber. Meanwhile, manufacturers have added things like salt, sugar, artificial colorings and flavorings, and preservatives.

These highly processed foods can alter the "good" bacteria that live in our guts. If the "bad" bacteria get the upper hand, that can trigger the immune system in a way that increases the risk of chronic inflammation. In a 2021 study, for instance, researchers found that a higher intake of ultra-processed food was positively associated with the risk of inflammatory bowel disease.

An earlier study, on the other hand, found that cutting back on the consumption of processed and fried foods reduced inflammation and helped restore the body's natural defenses against disease.

Action: Limit the number of foods you buy at the grocery store that are highly processed. Look for more whole foods like fruits, vegetables, and whole grains. Check the labels on cereals and choose those with fewer ingredients. Remember that frozen and canned fruits and vegetables are good unless they come with a lot of sugar or added sauces.

3. Fried Foods

If you're a big fan of French fries and fried chicken, it's time to find other favorite foods! That's because fried foods are known to increase inflammation.



These types of foods produce advanced glycation end products (AGEs)—harmful compounds formed when protein or fat combines with sugar in the bloodstream. AGEs can also form in foods during high-temperature cooking, such as frying.

The body has natural defenses against AGEs, but if you eat too many foods that have them, you can overload those defenses, allowing AGEs to accumulate in your system. As they become more pervasive, they cause oxidative stress and inflammation.

High levels of AGEs have been linked to a higher risk of type 2 diabetes, heart disease, and Alzheimer's disease—all inflammatory diseases.

Keep in mind that fried foods are often cooked in unhealthy oils that can further exacerbate their inflammatory effects.

Action: Limit your intake of fried foods, particularly from fast-food restaurants. Choose grilled and roasted meats and fish.

4. Alcohol

Some studies suggest that one drink per day—particularly red wine—may be good for heart health. But more than that can lead to health issues related to inflammation.

Alcoholic drinks add calories to your diet. That can increase your risk of gaining weight, which increases inflammation. Alcohol can also inflame the gut lining. As the lining weakens, it allows toxins to penetrate and travel to other parts of the body, where they cause inflammation.

In a 2010 study, researchers noted that alcohol can significantly increase inflammation in the gut. The liver and central nervous system work to counteract this effect, taming the inflammation, but over-consumption of alcohol can overwhelm these organs, leading to persistent body-wide inflammation.

Action: Limit your alcohol consumption to the recommended one drink per day.

5. Red and Processed Meats

We mentioned processed foods in general above, but processed meats deserve their own listing because of their potential to increase inflammation. We're talking about lunch meats, hot dogs, sausage, bacon, and other similar tasty items.

Why these foods may increase inflammation is still up for debate. According to one 2017 study, the intake of red and processed meat significantly increased inflammation only in those who were overweight. The scientists theorized that the meats may contribute to weight gain and body fat accumulation, which in turn, induced the related inflammatory process.

Other research has linked the regular intake of processed meats to an increased risk of inflammation and some cancers.

Scientists theorize this may be because these foods are potent sources of saturated fats and nitrates.

Action: All meat is not the same. Lean, grass-fed cuts are healthier than hot dogs and beef jerky. Processed meat is likely to be more inflammatory than other types of meat because it contains added salt, nitrates, preservatives, and other additives. Choose healthy cuts of meat, have meat-free days in your week, and do everything you can to maintain a healthy weight.



6. Refined Carbohydrates

These are foods that have been stripped of most of their fiber and nutrients. Examples include white pasta, white rice, white bread, and baked goods made of white flour, like donuts and cake. All of these foods break down quickly in the body, spiking blood sugar levels. Eat them too often and you could be risking insulin resistance, which can, in turn, increase inflammation.

In a 2014 review on carbohydrates and inflammation, researchers analyzed the results of 22 studies. They found that a low-glycemic diet—meaning one that contains few to no refined carbohydrates—showed significant anti-inflammatory effects.

In a later 2021 study, researchers looked at diet and inflammation in over 360 overweight women. They found that a diet higher in refined carbohydrates was related to an elevated risk of inflammation. An earlier study also found that women who ate more refined carbs had a greater risk of inflammatory diseases later in life.

Action: Choose more whole-grain products, as well as beans, peas, sweet potatoes, and other foods that are high in fiber and nutrients. Look at the ingredient list on foods like bread. The first ingredient should be a whole grain, not an “enriched” flour.

7. Too Many Omega-6 Fatty Acids

Omega-6 fatty acids are essential fatty acids that the body needs for normal growth and development. Unfortunately, the standard Western diet is much too high in these fatty acids, and too low in omega-3 fatty acids, which are naturally anti-inflammatory. Eating too many foods rich in omega-6 fatty acids can trigger the body to produce pro-inflammatory chemicals.



In a 2018 study, researchers found that people on a Western diet consume a lot of omega-6 fatty acids, which can increase the fatty acids in the membranes of cells involved in inflammation. Eating a balance of omega-6 and omega-3 fatty acids, however, allows the two to interact with each other in a way that reduces inflammation.

Another study found similar results—that balancing the intake of these two fatty acids could reduce the risk of chronic inflammatory diseases.

Omega-6 fatty acids are found in oils like those made from corn, safflower, sunflower, soy, peanut, and vegetables. They're also in mayonnaise, many salad dressings, and meats. Omega-3 fatty acids are found in fish and other seafood, nuts and seeds, plant oils (flaxseed), meats and dairy products from grass-fed animals, and fish oil supplements.

Action: Try to get a better balance of omega-3 and omega-6 foods in your diet. Usually, that means increasing your intake of fish, nuts, and omega-3 fortified eggs and dairy products.

Chapter 15

10 Foods That Help Tame Inflammation

In the last chapter, we talked about the foods you want to avoid to keep inflammation from growing out of control in your body. In this chapter, we're going to look at the opposite—those foods that can help reduce inflammation that may already be present or prevent chronic inflammation from taking hold.

Though scientists are still studying diet and its effect on inflammation, the results so far have been positive. In a 2021 study, for instance, they looked at over 1,000 older people who did not have dementia.

Each person answered a food frequency questionnaire commonly used to determine the inflammatory potential of a person's diet. A possible score could range from -8.87 to 7.98. A higher score indicates a more inflammatory diet—suggesting fewer servings of fruits, vegetables, beans, and tea or coffee.



Researchers then divided the participants into three groups:

1. Those with the lowest dietary inflammatory scores
2. Those with medium scores
3. Those with the highest scores

Three years later, some of the participants were diagnosed with dementia. The scientists found that each one-point increase in dietary inflammatory score was associated with a 21 percent increase in dementia risk. Compared to the lowest third of participants who consumed the least inflammatory diet, those in the top third were three times more likely to develop dementia.

In another study on dietary patterns and inflammation, researchers found that the Mediterranean diet had an “intense anti-inflammatory effect” on health, reducing the risk of inflammatory diseases like cardiovascular disease and type 2 diabetes.

Indeed, it's a healthy overall diet that is likely to have the largest impact on your inflammation. No single food will have the same impact. Eating a few blueberries along with a couple of cookies, for instance, probably won't help. But increasing your general intake of fruits and vegetables will.

When looking at your diet, consider increasing your intake of the following items to help protect yourself from the dangers of chronic inflammation.

1. Leafy Greens

These healthful vegetables are rich in powerful antioxidants that help protect the body's cells against destructive free radicals. They're also high in anti-inflammatory flavonoids—plant-based chemicals that help tame inflammation and prevent it from getting out of control.



In a 2020 study, researchers looked at patients advised to eat a diet rich in dark green leafy vegetables. They measured levels of C-reactive protein (CRP), an inflammatory marker in the blood, at least twice over the course of a year.

The results showed that adherence to this diet led to decreased levels of CRP. More specifically, the patients were able to lower their blood CRP levels from an average of about 7 to 1.75 within six months—a measurement that would

significantly lower the risk of cardiovascular disease. The researchers suggested that this type of diet may reduce the risk or the severity of chronic diseases involving inflammation.

2. Berries

Strawberries, blueberries, raspberries, and blackberries are all packed with fiber, vitamins, minerals, and antioxidants. They also have unique plant chemicals that tame inflammation, perhaps even reducing it in those who are overweight or obese.

In a recent 2021 review, scientists found that berries—in their raw form or when concentrated into fruit extracts or beverages—helped modulate pro-inflammatory markers and signaling pathways.

Cranberries, for instance, helped decrease the inflammation associated with non-alcoholic fatty liver disease. Blueberries helped significantly decrease pro-inflammatory cells in subjects that were fed a high-fat diet and also helped reduce swelling and inflammation in soft tissue wounds. Strawberries reduced the inflammatory response to a high-carbohydrate, moderate-fat meal in overweight adults.

In another 2021 study, researchers found that berries—including blackberries, blueberries, strawberries, and raspberries—inhibited inflammation and reduced free radicals in those who were obese.

3. Fatty Fish

Fatty fish like salmon, mackerel, herring, anchovies, and sardines are some of the best food sources of healthy omega-3 fatty acids like eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

These fatty acids are known to help reduce inflammation. The body metabolizes these into compounds called resolvins and protectins, which have anti-inflammatory effects.

Studies have shown that using fish oil supplements, which are rich in omega-3 fatty acids, has a significant benefit on inflammatory diseases, including decreased disease activity and a lowered use of anti-inflammatory drugs. In one 2019 review, scientists determined that omega-3 fatty acids may be associated with lower inflammatory markers among diabetic and cardiovascular patients.



In some studies, the effects have been so powerful that scientists have suggested that omega-3 fatty acid supplements would be useful as therapeutic agents in disorders with an inflammatory component.

4. Spices

Go ahead—add more flavor to your food. It’s good for you! Spices like turmeric, ginger, garlic, pepper, and cinnamon all have anti-inflammatory properties.

In a 2020 study, researchers found that adding six grams of spices to a meal high in fat and carbohydrates resulted in lower inflammatory markers hours later. The researchers used a blend of basil, bay leaf, black pepper, cinnamon, coriander, cumin, ginger, oregano, parsley, red pepper, rosemary, thyme, and turmeric.

Other studies have shown that spices can interact with multiple targets and alter inflammatory pathways associated with chronic diseases, including cardiovascular disease, arthritis, and cancer.

5. Tea

You probably already know that tea—green tea, in particular—has several potential health benefits. Research has shown that drinking it regularly is associated with a reduced risk of heart disease, cancer, obesity, Alzheimer's disease, and other diseases.

It’s the antioxidants in tea that help protect cells from free radical damage, while also reducing inflammation. In one study, scientists tested green and black tea and found that both possessed a “marked anti-inflammatory effect,” though green tea was more active than black tea.

Other studies have shown that the antioxidants in green tea can help relieve flare-ups associated with inflammatory bowel disease and other inflammation-driven diseases.

6. Tomatoes



Tomatoes are high in vitamin C, potassium, and lycopene—a powerful antioxidant that is also an anti-inflammatory agent. Research suggests that lycopene may be particularly effective at reducing pro-inflammatory compounds related to several types of cancer.

Regularly eating tomatoes has been linked to a reduced risk of chronic diseases like cardiovascular disease and type 2 diabetes. Tomatoes reduce inflammatory markers in overweight and obese

individuals. In a 2013 study, overweight or obese women who drank a little over a cup of tomato juice per day for 20 days significantly reduced their inflammation levels.

Tomatoes also contain a large number of anti-inflammatory compounds that target different inflammation cells and signals.

7. Olive Oil

Olive oil is a key component in the Mediterranean diet, which has been linked with lower levels of inflammation and a reduced risk of inflammatory diseases like cardiovascular diseases. It contains healthy omega-3 fatty acids, as well as other plant-based nutrients and chemicals that are good for human health.

Studies have found that virgin olive oil, in particular, contains numerous compounds that exert potent anti-inflammatory actions. One is called oleocanthal, and it seems to have similar anti-inflammatory properties to ibuprofen.

In an interesting large 2022 study involving more than 92,000 people, researchers found that high consumption of olive oil (a little more than half a tablespoon a day)—particularly when used to replace butter, mayonnaise, and margarine—was tied to a longer life span.

8. Nuts

Nuts such as almonds and walnuts are high in healthy omega-3 fatty acids, which as noted above, are powerful anti-inflammatory agents. They're also loaded with fiber and protein, so they can help keep you feeling full which may help you maintain a healthy weight.

Research shows that regular consumption of nuts is associated with lower levels of biomarkers of inflammation. In one study of more than 5,000 people, they found that those who consumed five or more servings of nuts per week had lower levels of C-reactive protein (CRP) and IL-6, both inflammatory markers, than those who never or rarely ate nuts.



Other studies have found similar results, with those who regularly eat nuts having a healthier profile when it comes to inflammatory markers.

9. Yogurt

You know that yogurt is a good source of healthy probiotics that can help replenish the "good" bacteria in your gut. Recent research also suggests that it may help reduce chronic inflammation.

In one study of over 1,700 people, for instance, researchers found that those who regularly consumed yogurt had lower levels of IL-6, a key inflammatory marker. The results held whether the participants were overweight or not.

Another recent study provided evidence that yogurt may help dampen chronic inflammation. Scientists enrolled 120 premenopausal women, half obese and half non-obese. Half ate 12 ounces of low-fat yogurt every day for nine weeks. The other half ate non-dairy pudding for the same period.

The results showed that the ongoing consumption of yogurt had a general anti-inflammatory effect. Eating eight ounces of yogurt before a meal also helped improve post-meal metabolism, which could reduce the risk of cardiovascular and metabolic diseases.

10. Broccoli

Broccoli seems to show up whenever we're talking about healthy foods, and this is no exception. In addition to its powerful antioxidants, it also has strong anti-inflammatory components.



In a 2018 study, researchers analyzed data from men and women aged 35 to 55 years with a body mass index (BMI) between 24.9 and 29.9 (indicating overweight). They gave them fresh, raw broccoli sprouts weekly for 10 weeks. Eating the broccoli sprouts reduced both CRP and IL-6 levels, dropping chronic inflammation levels.

Another study found that young male smokers who ate a typical serving of broccoli once a day for 10 days saw a reduction in CRP by an average of 48 percent! This is a powerful result as smoking is known to increase inflammation.

Look to Adopt a Generally Healthy Diet

All of these foods are great ones to add to your anti-inflammatory diet. They are not the only ones, however. Studies have indicated that other healthy foods like cherries, oranges, avocados, dark chocolate, beets, seeds, and more can all help fight against chronic inflammation.

The key is to do your best to incorporate more of these healthy foods into your diet every day while limiting those we mentioned in the last chapter that can increase inflammation. Achieving a balance is the ultimate goal.

Chapter 16

7 Lifestyle Tips to Prevent and Reduce Chronic Inflammation

Throughout this ebook, we've been talking about the impact healthy lifestyle habits can have on the amount of inflammation in your body.

In one study, for instance, researchers split participants with high cholesterol into four intervention groups:

1. Healthy diet
2. More exercise
3. Healthy diet and more exercise
4. Controls (no changes)

After six months, results showed that all three of the interventions helped reduce levels of inflammatory markers in the blood. The biggest changes were seen in those who adopted a healthy diet and a daily exercise program.



So, no matter where you are right now, making small changes toward a healthier lifestyle can help! Below are seven suggestions of new habits you can adopt that will not only help keep inflammation under control but may also help you live a longer, more active, and vibrant life.

1. Eat a Healthy Diet

As we discussed in the last two chapters, what you eat can have a large impact on the inflammation inside you.

Spend a week or two keeping a food diary. You may be surprised at what it shows you. Perhaps you're eating more processed foods than you thought, drinking too many sugar-sweetened beverages, or neglecting your fruits and vegetables.

If you're looking for a healthy diet to follow, you can't go wrong with the Mediterranean diet. It has been shown in studies to have many health benefits, including reducing the risk of inflammatory diseases, including cardiovascular disease, diabetes, arthritis, cancer, and obstructive sleep apnea. It's also been associated with a significant reduction in total mortality.

Some studies have shown specifically that those adopting this diet had less inflammation.

To switch to the Mediterranean diet, eat:

- A wide variety of vegetables, fruits, and whole grains
- Healthful fats like those in nuts, seeds, and olive oil
- Moderate amounts of dairy and fish
- Very little white meat and red meat
- Few eggs
- Red wine in moderation



Some other tips:

- Use olive oil when cooking, and switch to some new salad dressings with olive oil as the base. Use olive oil in place of butter on your toasted bread.
- Eat a handful of nuts every day, maybe with a few olives thrown in.
- Add whole-grain bread or other whole grains to your meals. Experiment with bulgur, barley, farro, couscous, and whole-grain pasta.
- Begin or end each meal with a salad.
- Add more and different veggies to the menu.
- Eat at least three servings per week of legumes, including lentils, chickpeas, beans, and peas.
- Eat less meat, and choose lean cuts in small portions. Eat more fish.
- Substitute wine in moderation for other alcoholic beverages.
- Cut out sugary beverages and replace them with water and tea.
- Eat fewer high-fat, high-sugar desserts, and replace them with fresh, poached, or baked fruit.

2. Consider Intermittent Fasting

If you'd like to lose a few pounds, try intermittent fasting. Of all forms of dieting, this has been found to help fight inflammation.

For this type of fasting, you simply eat during a certain window of time, then refrain from eating the rest of the time. The easiest way to start is with a 12-hour fast. That means if you finish dinner at 8:00 at night, you don't eat anymore after that until breakfast at 8:00 in the morning.

In a 2012 study, researchers examined about 50 volunteers who regularly practiced intermittent fasting. They measured the inflammatory markers in their blood and found that inflammation was significantly lower during the fasting period compared to after the fasting.

In a later 2014 study, researchers found that periods of fasting could limit inflammation, improve blood sugar levels, and reduce blood pressure. Mount Sinai researchers also found that fasting reduced inflammation and improved chronic inflammatory diseases.

Other ways to employ this type of fasting include the following:

- Eat only for 8 hours each day and fast for the remainder.
- Choose to eat only one meal a day two days a week.
- Engage in a 24-hour fast once or twice per week.

3. Dump the Bad Habits

Smoking and drinking to excess are two bad habits known to increase inflammation. If either of these is plaguing you now, talk to your doctor about how you may be able to quit.



Smoking triggers an immune response that is associated with increased levels of inflammation. Several studies suggest that the changes smoking creates in the body predict future health problems like heart attacks and cancer. According to the Centers for Disease Control and Prevention (CDC), on average, smokers die 10 years earlier than nonsmokers.

In large amounts, alcohol can overwhelm the gastrointestinal tract and liver and damage both. Specifically, alcohol

promotes intestinal inflammation that exacerbates alcohol-induced organ damage, creating a vicious cycle leading to life-threatening disease.

Moderate amounts of alcohol, on the other hand, may be protective against inflammation. We're still not sure about this though, as some studies suggest that any more than one drink per day can have negative health effects.

Your best bet is to stop smoking altogether and to make sure to keep your alcohol intake to a moderate level.

4. Exercise Regularly

If you don't have an exercise program right now in your life, it's time to get one. Of all the things you can do for your overall health, exercise may be the most important. It's tied with a lower risk of almost every type of disease, including cardiovascular disease, type 2 diabetes, cancer, and dementia.

Research also shows that regular exercise reduces inflammation, while a sedentary lifestyle exacerbates it. In one study, scientists found that just one 20-minute session of moderate exercise stimulated the immune system, producing an anti-inflammatory result.

In a 2020 review of 18 studies, scientists found that moderate exercise or vigorous exercise with appropriate rest periods (like high-intensity exercise) achieved the maximum benefit in reducing inflammation. That means you can simply go for a brisk walk or bike ride, jog for 20 minutes, swim a few laps, play a game of tennis, or go dancing and receive the health benefits.

You don't have to kill yourself either. Long bouts of super heavy exercise can actually stimulate inflammation. Instead, make a point to get moving for about 30 minutes a day at any sort of exercise that you enjoy.

5. Maintain a Healthy Weight

We all tend to gain a little weight as we get older. This is due to a combination of several factors. We slow down, exercise less, and eat more, often in response to hormonal changes.

This isn't harmless weight gain, though. The more fat you have on your body, the more inflammation you're likely to have too. Remember that fat cells, by their very nature, are inflammatory. Overeating also stresses the body and stimulates inflammation.

If you're overweight, talk to your doctor. Losing even 5-10 pounds can make a big difference in your inflammation levels and your overall health. In a 2018 review, researchers analyzed 76 studies involving a total of over 6,700 people who were all obese. They found that in most of the studies, weight loss caused a significant reduction in levels of inflammatory markers in the blood.

If you've tried to lose weight and failed, consider this: inflammation may be the problem. When inflammation is present, even the most disciplined eating and exercise habits might not help. In that case, focus specifically on your diet and the other habits listed here so you can reduce that inflammation. That may help you shed a few more pounds.

6. Get 7-8 Hours of Sleep Per Night

We are a sleep-deprived nation, and that is stoking the inflammatory fires in our bodies. In 2016, the CDC reported that more than a third of Americans aren't getting enough sleep. (Experts recommend 7-8 hours per night.)

Sleep loss, in turn, is closely tied to inflammation. Studies show that both healthy individuals who miss out on a good night's sleep and those who get 7-8 hours of sleep only about half the time experience increases in inflammation.



In a 2015 review of 72 studies, researchers found that sleep disturbance was associated with higher levels of C-reactive protein (CRP) and IL-6. Sleeping for too long, too—9 hours or more—is also associated with higher levels of inflammatory markers.

Consistency is key. Go to bed and get up at the same time every day, even on the weekends. Keep all technology, including phones and televisions, out of the bedroom. Make sure you have a comfortable, supportive mattress. And practice a before-bed routine that includes at least 30 minutes of a quiet, dimly lighted activity such as listening to calming music, taking a warm bath, or reading.

7. Manage Your Stress Levels



It's normal to feel stress now and then, but optimally, the stress passes, and your mind and body calm down. Chronic stress, however—which many people suffer from today—tends to stick around far too long, and that can hurt your health.

Scientists have known for some time that chronic stress can increase the risk of diseases like atherosclerosis, fatty liver disease, and depression. But why that is has been puzzling. Recently, they have found evidence showing that a common pathway for stress-related diseases is

based on chronic inflammation.

In a study at Carnegie Mellon University, scientists discovered that chronic psychological stress is associated with the body losing its ability to regulate the inflammatory response. This can then promote the development and progression of disease.

We can't expect to live a life without stress. The solution is to find ways to shed it every day. Just like you need to eat a healthy diet and exercise every day, so too do you need to engage in a daily stress-relieving activity.

Good options include the following:

- Yoga or tai chi
- Meditation
- Journaling
- Deep breathing
- Massage
- Art and music therapy

- Walking in the park or around other natural areas
- Crafting—knitting, crocheting, woodworking
- Gardening
- Photography, particularly nature photography
- Progressive muscle relaxation
- Aromatherapy
- Baking
- Reading

Make Small Changes, a Little Bit at a Time

All of these are common-sense tips about how to live a healthy life. Sometimes we can forget, however, how important they are to our health and well-being.

If you find that you've been neglecting yourself, try a reset. Take some time this weekend to examine your daily routine and decide on one healthy change you want to make. Spend the next few weeks focusing on that one change. Maybe you want to take a walk three times a week or sign up for a yoga class.

Once you have that new habit in place, take some time to examine your routine again and come up with the next change. If you practice this process for the next six months, you'll be able to significantly lower the inflammation in your body.



You don't have to change everything at once. Focus on little steps, one habit at a time. You'll thank yourself in the future!

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About Exercises For Injuries

Exercises For Injuries – Your Trusted Resource for Pain-free Living

Recognized as a global leader in injury prevention and recovery since 2008!

At Exercises For Injuries (EFI), we recognize that traditional exercise and treatment programs often do not produce the results that people are looking for. We believe that understanding the cause of injuries and painful conditions can help heal and prevent them. Therefore, our programs are based on years of research, study, creativity and hands-on testing. Our methods successfully determine what works to heal injuries and eliminate pain *without expensive appointments, addictive prescriptions or risk-laden surgery*.

Often recognized as the “Trainer to the Trainers” and the “Expert to the Experts,” company founder Rick Kaselj has been featured in major publications such as Livestrong.com, Men’s Health magazine, the San Francisco Chronicle, Canada.com, Iron Man Magazine, Men’s Journal magazine, and has delivered presentations and seminars to *more than 6,000 health and fitness professionals across North America*. As an internationally renowned injury and pain expert, Kinesiologist, author and public speaker, Rick has made it his personal mission to make his groundbreaking programs available to as many people as possible so that they can return to pain-free lives.

Today, the EFI team is comprised of health and wellness experts from around the world. We help hundreds of thousands of people each year live fuller, healthier, pain-free lives by addressing all areas of health, fitness and personal well-being.

Access our vast FREE library of health-promoting recipes, pain-relief resources and injury recovery information, online at ExercisesForInjuries.com

About Rick Kaselj

Hi, I'm Rick Kaselj. I create exercise programs that help people heal injuries, eliminate pain, lose weight, increase energy and more ... so they can go back to living a full, active, healthy life.

Here are a few relevant facts about me:

- I've been a Kinesiologist and pain and injury specialist since 1994.
- I spent six years at university studying Kinesiology, corrective exercise and therapeutic exercise and got my master's degree in exercise science.
- I have 25+ years of hands-on experience, working directly with clients and teaching my techniques and programs to fitness professionals, Kinesiologists and healthcare providers.
- I have personally conducted thousands of personal training sessions.
- I have reviewed and carefully scrutinized hundreds of scientific and medical research papers and studies.
- I'm also an author and speaker, and I've given more than 260 presentations to more than 6,000 fitness professionals across Canada and the U.S.



I USE RESEARCH, STUDY AND HANDS-ON TESTING TO FIND WHAT REALLY WORKS TO HEAL INJURIES AND ELIMINATE PAIN

I'm all about finding what works ... and, unfortunately, much of the advice out there, even from trained professionals and reputable sources ... does not work!

Some of the most effective methods I've discovered for eliminating pain and healing injuries are *counterintuitive* — they required extensive research, testing and *creativity* to discover.

People get the best results when they follow a program that's been *designed properly*. The best programs include only the exercises that are necessary, instructions for how to perform them properly, the proper order in which to perform them and instructions for what the right amount of rest is and when to take it.

What Our Customers Say

"Your exercises have changed my life. I have been in constant pain for 15 years."

— **Shelley Watson, Carmel, California**

"I just wanted to say thank you for providing what I needed to resolve my hip problem! After following your exercises, I went through work all day with no pain and no pain medication. Yeah! Thanks so much for a simple answer to a problem I have been dealing with for months."

— **Tracy Walker, North Carolina**

"Before I used the information, I couldn't walk normally for at least the first 15 minutes each morning. After using the program, I only have a little pain but, eventually, it all got better with continued attention."

— **Cher Anderson, Athens, Tennessee**

"Thank you, Rick. You saved my career!"

— **Marco Mura, Professional Forester, Sardegna, Italy**

"I thought I would just have to retire due to foot pain, but now my pain is gone with your program. It has helped me a lot. Thank you, Rick!"

— **Audal Acosta**

"I noticed a difference by the second morning. I was able to get up out of bed without the immediate pain and stiffness I am used to experiencing in the morning. I am now able to walk 1.5 miles without pain during or after my walk. That is exciting! I was in constant pain before I started the program and now, I am able to take walks with my husband, pain-free."

— **Jennifer Dixon, Payroll Supervisor, CPP, Wenatchee, Washington**

"I have suffered with plantar fasciitis for over a year, with no relief, no matter what I tried. One week into your program, and I'm able to do exercises that I have been unable to perform for some time now."

— **Dave Elder, CFT, Infinite Fitness, Fort Wayne, Indiana**

"The best thing about the program is that it starts to work quickly. I have already started to notice improvement. My heel says, 'Thank You, Rick!'"

— **Sue, Former Fitness Instructor**

Free DVD Offer

I HAVE A FREE GIFT FOR YOU... *THAT WILL START DECREASING YOUR PAIN NOW!*

I want to send you some of my very best *pain-hacking techniques* FOR FREE!

It's a DVD called "The Pain Hacker," and I **want you to have it for free.**

On the DVD, you'll find an extensive collection of 90-second pain fixes, which are exactly what they sound like — techniques you can do in just 90 seconds that can start reducing your pain almost immediately! In the video, I go through each technique slowly and carefully to show you exactly how to do them. Here's what you can look forward to:



- "The Pain Hacker" DVD contains 90-second fixes for shoulder pain, back pain, knee pain, elbow pain, foot pain, neck pain, wrist pain, hip pain, hand pain and more.
- The pain techniques in this DVD will work for you regardless of your current health condition, gender or age.
- **TWO SURPRISE BONUSES!** With your free DVD, I'm also going to throw in two bonus programs that will teach you simple exercises that could radically change the way you feel from day to day.

We have limited supplies right now ... so get your FREE copy of "The Pain Hacker" DVD before we run out. Go here to get yours now:

ThePainHacker.com/Free-DVD-2

Our TOP 5 Best Selling Exercise Programs

#1: The Whole Enchilada

The “Whole Enchilada” is the most comprehensive collection of research-based and scientifically proven pain and injury recovery programs available anywhere. This package includes a total of 31 unique exercise programs, each designed to heal a specific injury, eliminate a specific pain, or help improve your health in a specific way.

These programs WORK, because they were all developed using the most cutting-edge research, scientific studies, and medical papers. Here are the programs included:



- *10 Easy Movements for Hip Bursitis*
- *Achilles Tendinitis Exercise Solution*
- *Ankle Sprain Solved*
- *Arthritis Handbook*
- *Balance Training Handbook*
- *Best Gluteus Maximus Exercises*
- *Best Gluteus Medius Exercises*
- *Effective Rotator Cuff Exercises*
- *Frozen Shoulder Solution*
- *Hamstring Injury Solution*
- *Hip Replacement Handbook*
- *Illiotal Band Syndrome Solution*
- *Jumper's Knee Solution*
- *Knee Pain Solved*
- *Knee Replacement Handbook*
- *Low Back Pain Solved*
- *Lumbar Spinal Fusion Recovery*
- *Meniscus Tear Solution*
- *Neck Pain Solved*
- *Patellofemoral Syndrome Solution*
- *Piriformis Syndrome Solution*
- *Plantar Fasciitis Relief in 7 Days*
- *Recovery Workouts*
- *Sacroiliac Pain Solution*
- *Scapular Stabilization Exercises*
- *Shin Splints Solved*
- *Shoulder Pain Solved*
- *Tennis Elbow Pain Solution*
- *Thoracic Outlet Syndrome Solves*
- *Unlock Your Tight Ankles*
- *Unlock Your Tight Shoulders*

When you order "The Whole Enchilada", we'll send you a USB Flash Drive that comes pre-loaded with all 31 programs. You only need to plug it in your computer or gadget to instantly access the programs.

Visit: [ExercisesForInjuries.com/Shop](https://www.ExercisesForInjuries.com/Shop)

Type or paste in the Search box one or more keywords of the product name: **The Whole Enchilada.**

#2: Flexibility Over 40 Handbook

You probably already know that inflexibility can lead to balance problems, which can lead to dangerous falls, which can lead to serious injuries... especially in older individuals.

But did you know that inflexibility may be a signal that your arteries are clogged?

SCIENTIFIC RESEARCH has shown that a specific kind of stretching can improve your balance (so you can avoid dangerous falls and injuries), and may even help prevent and reverse heart disease.

Here is some good news...

- Improving your flexibility can make you feel better than you have in years (maybe even decades!)
- Improving your flexibility can make it much easier to do your day-to-day tasks and movements.
- Improving your flexibility can help you resume the activities you LOVE.
- Improving your flexibility can help you regain solid balance and stability.
- Improving your flexibility can help you prevent, and possibly even reverse heart disease.

IMPORTANT NOTE: Most exercise programs that improve flexibility are too advanced and too difficult for older adults, but the stretching routine in our Flexibility Over 40 program was designed specifically for women and men over the age of 40.

Visit: [ExercisesForInjuries.com/Shop](https://www.ExercisesForInjuries.com/Shop)

Type or paste in the Search box one or more keywords of the product name: **Flexibility Over 40 Handbook.**



#3: Piriformis Syndrome Solved

At last, there is a comprehensive, yet simple to follow program that contains the exercises you need to know to naturally rid yourself of Piriformis Syndrome pain.

Imagine being able to bend over or walk up stairs without feeling sharp pain...

Imagine no longer having to spend your money on injections, pain medication and inferior solutions that only work temporarily, or worse, not at all...

Imagine being able to play your favorite sport once again, pain free...

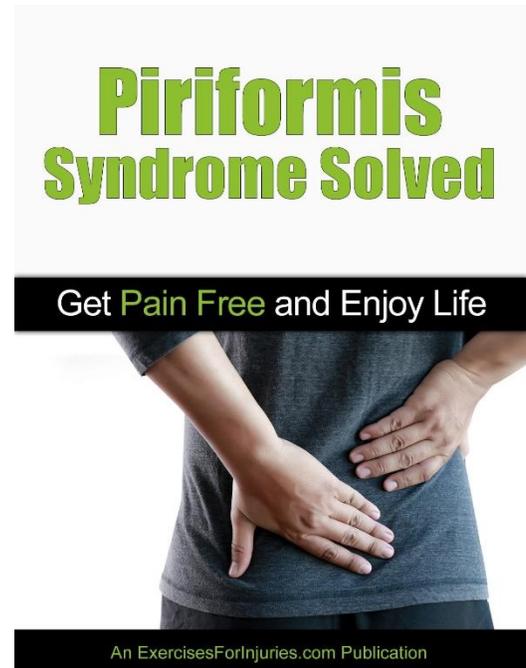
The Piriformis Syndrome Solution is filled with expert tips and exercises that will allow you to eliminate discomfort and pain as fast as possible.

Plus, with the videos, you can see exactly how to properly execute the exercises, so you can avoid using bad form that could negatively impact your results.

Save yourself money and frustration – get the Piriformis Syndrome Solved today and restore pain-free movement!

Visit: ExercisesForInjuries.com/Shop

Type or paste in the Search box one or more keywords of the product name: **Piriformis Syndrome Solved.**



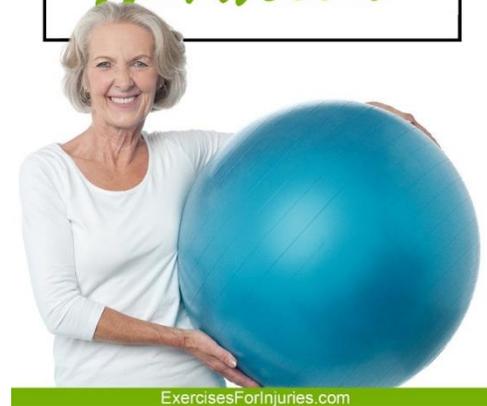
#4: Balance Training Handbook

Regain Your Balance and Your CONFIDENCE with the Balance Training Handbook.

This simple, easy, gentle 8-minute exercise routine will help you improve your balance, prevent falls and protect you from the “bad balance negative downward health spiral.”

Replace your fears of falling and increase your physical activity with confidence! Strengthen your legs, stabilize and strengthen your core and get back to living your life fully.

Return to doing the day-to-day things you NEED to do, and doing them YOURSELF, so you don't have to depend on or burden other people!



Visit: [ExercisesForInjuries.com/Shop](https://www.ExercisesForInjuries.com/Shop)

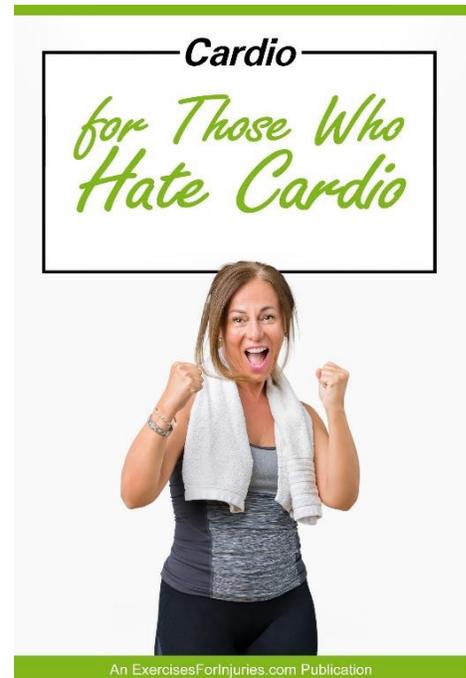
Type or paste in the Search box one or more keywords of the product name: **Balance Training Handbook**

#5: Cardio for Those Who Hate Cardio

Cardiovascular exercise has been proven to help keep your heart healthy... but you HATE CARDIO!

Did you know... you don't have to do "traditional" cardio exercises? This program provides you with a much easier and more enjoyable way to keep your heart healthy, get fit, feel great, and even lose weight.

- This program is designed specifically for women and men over the age of 45, so it's gentle, safe, and very easy to do.
- It's also fast—you can do the entire routine in under 7 minutes a day.
- And you don't need a gym, any expensive equipment, or special workout clothes.
- This program can ALSO help you lose weight (because you'll be burning more calories throughout the day automatically), increase your energy, prevent injuries, improve coordination and balance, improve your flexibility, and protect against chronic pain



So, get moving today! Burn those calories and invest in your heart-health without the typical boring cardio activities that most people dread.

Visit: [ExercisesForInjuries.com/Shop](https://www.ExercisesForInjuries.com/Shop)

Type or paste in the Search box one or more keywords of the product name: **Cardio For Those Who Hate Cardio.**

GOT PAIN? We Have a Program for You

If you have a specific pain or injury you need help with... *you're in the right place*. For 25+ years, Rick Kaselj has been developing easy-to-learn, easy-to-do, highly-effective, research-based, low-impact exercise programs that are designed to reduce, heal and eliminate *specific* pains and injuries. **Below are just some of Rick's programs, categorized by pain and injury:**

BACK PAIN

- Best Gluteus Medius Exercises (back and hip pain)
- Best Gluteus Maximus Exercises (low back, hip and knee pain)
- Sacroiliac Pain Solution (low back pain)
- Lumbar Fusion Exercises (recover faster from lumbar fusion surgery)
- Effective Exercises for Scoliosis (back pain)
- Low Back Pain Solved (low back pain)

KNEE PAIN

- Patellofemoral Syndrome Solution (knee pain)
- Best Gluteus Maximus Exercises (low back, hip and knee pain)
- Knee Replacement Handbook (recover faster from knee replacement surgery)
- Iliotibial Band Syndrome (knee pain)
- Meniscus Tear Solution (knee pain)
- Jumper's Knee Solution (knee pain)
- Knee Pain Solved (knee pain)

FOOT, HEEL & ANKLE PAIN

- Plantar Fasciitis Relief in 7 Days (foot and heel pain)
- Ankle Sprain Solved (ankle pain)
- Unlock Your Tight Ankles (ankle pain)

SHOULDER PAIN

- Thoracic Outlet Syndrome Solved (shoulder, neck and arm pain)
- Frozen Shoulder Solution (shoulder pain)
- Effective Rotator Cuff Exercises (shoulder pain)
- Scapular Stabilization Exercises (shoulder pain)
- Shoulder Pain Solved (shoulder pain)
- Unlock Your Tight Shoulders (shoulder pain)

NECK PAIN

- Neck Pain Solved (neck pain)
- Thoracic Outlet Syndrome Solved (shoulder, neck and arm pain)

LEG PAIN

- Hamstring Injury Solution (hamstring pain)
- Shin Splints Solved (shin pain)
- Achilles Tendonitis Exercise Solution (calf pain)

MISCELLANEOUS

- Arthritis Handbook (joint pain)
- Piriformis Syndrome Solved (buttock pain)
- Recovery Workouts (speed up recovery between workouts)
- Tennis Elbow Pain Solution (elbow pain)

**To find out more about any of these
or our other pain, injury or exercise programs, go to:**
[**ExercisesForInjuries.com/Shop**](https://ExercisesForInjuries.com/Shop)