THE THRILL OF KRILL

What You Should Know About Krill Oil

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Introduction

Imagine a natural supplement that is able to do the following:

- Protect against cardiovascular disease and stroke.
- Lower blood pressure and cholesterol.
- Reduce arthritis pain.
- Moderate premenstrual discomfort.
- Relieve symptoms of menopause.
- Alleviate depression.
- Combat dementia.
- Slow down the aging process.

As a practicing physician specializing in cardiology and integrative medicine, I dedicate a great deal of my time to validating or refuting such statements, which are often made by nutraceutical companies. I feel it is my responsibility to research and find out as much as I can about a particular supplement before recommending it to my patients—or before taking it myself. When it comes to the omega-3 fatty acids, there has been a large body of scientific research to sift through. But in doing so, I have been convinced that these beneficial fats have met my high standards for recom-

mendation, and that krill oil is the best and safest way to obtain them. In this book, I have shared my findings with you.

To best safeguard your health, being proactive is key. Along with having annual checkups, it's important to eat a healthy diet and exercise regularly. What is perhaps just as important is listening to your body—after all, you know it better than anyone else. Whenever there is a health concern, seek medical help and educate yourself on the condition. By understanding the problem and by becoming aware of its symptoms and underlying cause (or causes), you will become better equipped to take control and actually do something to help yourself.

While making positive lifestyle changes can drastically improve the quality of your life, science has also shown that the right nutrients can help treat, reverse, and even prevent many serious diseases and health conditions. And that is exactly what I hope to show you in this book. I am a strong supporter of natural alternatives, which tend to be well-tolerated and "do no harm." Pharmaceutical drugs have a legitimate place, but in many cases, natural alternatives may work just as well, and without negative side effects.

Throughout my career, I have researched and studied over one-hundred nutrients. Among the important lessons I've learned is that just because a nutritional supplement (or anything you put in your mouth) is natural and supposedly "does no harm," it is not necessarily good for you. Before I am convinced of the merits of a nutrient, I always have three questions in mind:

- Is there enough clinical evidence (that is, well-conducted research studies) that shows a beneficial effect? Is it sufficient enough to recommend the nutrient to my patients and to take it myself?
- Is the evidence consistent and robust enough to conclude that the nutrient has proven benefits?
- Is it safe? Does it have any significant side effects?

For decades, medical researchers have extolled the many health benefits of the essential fatty acids known as omega-3s.

Vital to the optimal functioning of virtually every cell, organ, and system in our bodies, omega-3s help keep our systems in balance. Because the body cannot manufacture them in adequate amounts, we must obtain these "good fats" through diet and supplements. While fish oil has long been viewed as the best omega-3 supplement, I have discovered that there is now an even better alternative—oil sourced from tiny ocean-dwelling crustaceans called krill. I have written *The Thrill of Krill* to share this important discovery with you.

Designed to provide a clear understanding of the benefits and uses of supplemental krill oil, *The Thrill of Krill* opens with informative chapters on the role of omega-3s in improving and sustaining good health. Included is a breakdown of these essential nutrients along with a brief look at their use throughout history, which dates as far back as the ancient Romans, who reserved this "health elixir" for soldiers and nobility. As the various natural sources of these healthful fats are presented, you will learn how the oil from ocean-dwelling krill is a superior source—and discover how something that is such a tiny part of the vast ocean can have such a dramatic impact on good health.

Chapters that follow focus on the proven effectiveness of krill oil and its rich omega-3 content on treating (and even preventing in some cases) a number of common, often debilitating health problems. Included are its role in fighting such serious cardiovascular conditions such as atherosclerosis, coronary heart disease, high blood pressure, and stroke, as well as its effectiveness in reducing the painful symptoms of rheumatoid and osteoarthritis. The chapter on women's health covers the management of such significant conditions as premenstrual syndrome, dysmenorrhea (painful menstruation), and menopause. It also presents the importance of omega-3s during pregnancy and lactation—for both mother and child. Krill oil's role in managing depression and treating neurological-based disorders like attention deficit hyperactivity disorder (ADHD), dementia, and Alzheimer's disease is discussed, as is its effectiveness in reducing chronic inflammation and the broad spectrum of disorders it can cause or exacerbate, such as lupus, asthma, inflammatory bowel disease, and cancer.

High levels of the omega-3s found in krill oil have also been associated with a slower progression of the aging process itself—and its wide spectrum of age-related disorders.

A solid foundation of medical research has long supported the extensive health benefits of omega-3 fatty acids. With krill oil as a superior source of these valuable nutrients, I hope you consider making them—along with a healthy diet and lifestyle—part of your daily regimen for overall fitness and well-being.

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Dealing with Health Conditions

When facing any type of health concern, from a simple headache or aching joints to more serious issues like high blood pressure or a heart condition, most people head for the medicine cabinet. It's how we've been conditioned. There are, of course, times when there is no other choice than to treat certain problems with pharmaceuticals, whether they are over-the-counter treatments or a doctor's prescribed drugs. It is well-documented, however, that when it comes to using medications, our bodies don't get something for nothing. We've all heard those commercials touting the benefits of a drug that promises life-changing results, only to be followed by its potential side effects—typically mentioned with the rapid-fire speech of an auctioneer. The fact is, every drug comes with a downside (often, more than one), which can be as mild as occasional dizziness or nausea, or as serious as coma or even death. No wonder more and more people are choosing to treat their ailments with natural alternatives like vitamins, herbs, and other dietary supplements.

What is just as distressing as the additional health issues caused by a medication's side effects is the fact that although the drug may reduce or eliminate the symptoms it is meant to treat, it doesn't necessarily resolve the underlying condition. There is, of course, a legitimate place for certain drugs, which should *always*

be taken under the guidance of a healthcare professional. As a physician, I am always weighing the benefits versus the risks of any prescribed medication or procedure. Increasingly, however, doctors are becoming more accepting of natural alternatives. For the most part, these supplements tend to be well-tolerated and do "no harm," and many have been proven effective in treating a variety of conditions. I have dedicated myself to studying these natural alternatives, and have been impressed by many of my findings. Among the most effective and powerful of these core nutrients, which have been scientifically proven to provide abundant medical benefits, are the omega-3 fatty acids.

Essential to the optimal functioning of virtually every cell, organ, and system in our bodies, omega-3s help keep our systems in balance. Because the body cannot manufacture adequate amounts of these fats, we must obtain them through diet and natural supplements.

Research has shown that maintaining the body's natural balance of the right omega-3s may improve or even prevent a broad spectrum of debilitating disorders and conditions, in particular those caused by inflammation; cardiovascular disease; poor memory; cognitive decline; and autoimmune disorders. They also have positive effects on hormone-related issues like thyroid conditions, depression, and mood swings. Later chapters will detail the potential healing power of omega-3s on these and other health problems.

In summary, omega-3s offer multiple benefits for good health, and have been associated with the following:

- Reducing the risk of heart attack and stroke.
- Lowering elevated triglyceride levels.
- Alleviating depression.
- Reducing the inflammation associated with asthma.
- Curbing the stiffness and joint pain of arthritis.
- Protecting against Alzheimer's disease and dementia.

- Slowing the gradual memory loss due to aging.
- Playing an important role in the visual and neurological development in infants.
- Reducing the symptoms of ADHD in some children.
- Benefitting skin health—reducing wrinkles and controlling conditions like psoriasis.
- Increasing the effectiveness of anti-inflammatory medications, as well as antidepressants.

As you will see, while a lack of omega-3s can bring about a number of health issues, restoring proper levels can help the body resolve them. Even more importantly, maintaining appropriate levels can play a part in the prevention of these conditions and the maintenance of good health.

Before going further, it's important to first understand more about dietary fat with a focus on omega-3s.

DIETARY FAT—THE GOOD AND THE BAD

When most people think of a high-fat diet, they associate it with serious health risks, from obesity and diabetes to inflammation and heart disease. Interestingly, Americans consume less total fat today than they did in the 1960s, yet rates of obesity and heart disease are higher—and continue to climb. According to recent studies, one reason is the dietary increase of high-glycemic carbohydrates, which cause insulin resistance and heighten the risk of obesity, diabetes, and heart disease. High intake of refined sugars, which are contained in soft drinks, candy, baked goods, and other sweets, is also strongly associated with high triglycerides (fats in the blood).

When it comes to fats, the focus has shifted to the *type* that is eaten, not the quantity. The right fats, when consumed in moderation, are an essential component of a well-rounded, healthy diet. Knowing the "good" fats from the "bad" will help you make smarter dietary choices and, as a result, maintain good health.

Saturated Fats

The main dietary cause of high cholesterol and unhealthy weight gain, saturated fats are found primarily in fatty animal proteins such as beef and pork, as well as in full-fat dairy products like whole milk, butter, and cheese. They are typically solid at room temperature. Due to the detrimental effect of saturated fats on overall health, reducing their consumption is strongly recommended. Choose lean meats and reduced-fat dairy products, and cook with healthier oils, such as olive oil and vegetable-based oils.

Trans Fats

Also known as *trans-fatty acids*, trans fats are produced when vegetable oils are hydrogenated to make them more solid and stable. The hydrogenation process also prolongs the oil's shelf life, which is why trans fats are often used to make processed foods, fast foods, commercial baked goods, and solid margarine. In the recent past, many food manufacturers have taken steps to remove this ingredient from their products, as scientists have discovered that trans fats from partially hydrogenated oils are even more harmful than saturated fats. They increase the level of low-density lipoproteins (LDLs)—the "bad" cholesterol—while decreasing high-density lipoproteins (HDLs)—the "good" cholesterol. (For more information, see the inset "Cholesterol" on page 12.)

We must try to avoid trans fats at all costs by staying away from commercially prepared baked items (cakes, cookies, donuts, muffins, etc.), solid margarine, and foods that are fried in partially hydrogenated oils. When buying packaged foods, be sure to check nutrition labels. If the product contains partially hydrogenated oil, it also contains trans fats and should be avoided.

Unsaturated Fats

Coming primarily from vegetable and marine sources, unsaturated fats tend to be liquid at room temperature. They consist of monounsaturated fats and polyunsaturated fats, which are both

considered "good" fats. Keep in mind, however, that all fats—both good and bad—are dense in calories, so even unsaturated fats should be consumed in moderation.

Monounsaturated Fats

Healthy monounsaturated fats reduce LDL levels without causing a negative impact on HDL cholesterol. They also provide nutrients to help keep the body's cells healthy. Foods high in monounsaturated fats include a number of plant-based oils, such as olive, canola, peanut, safflower, and sesame oils. Avocados, peanuts, macadamia nuts, and hazelnuts are other rich sources.

Polyunsaturated Fats

Essential for good health, polyunsaturated fats lower LDL cholesterol and triglycerides. Like monounsaturated fats, they also provide nutrients to help maintain the body's cells. Two groups in particular, omega-3 and omega-6, must be obtained through the diet, as they are not adequately produced by the body. Omega-6 fats are plentiful in a number of foods, from nuts and seeds to vegetable oils, so most people consume sufficient amounts without even trying. Omega-3s, on the other hand, are not as abundant. They are found mainly in fatty fish like salmon, herring, and trout, which contain the beneficial "long-chain" fatty acids EPA and DHA. The suggested dietary intake of this type of fish is three times a week. (It must also be noted that cooking fish at high temperatures breaks down a high proportion of EPA and DHA.)

Krill—tiny shrimp-like crustaceans—are another very rich source of EPA and DHA, as well as phospholipids and highly potent antioxidants. The oil sourced from krill is available as a superior supplement. Other sources of omega-3s are discussed in detail in the next chapters. For additional information on the Omega Groups, see page 10.

Understanding the variation among fats is an important step towards achieving a wholesome diet. Including the right amount of good fat while reducing consumption of saturated fats and

eliminating trans fats is key to good health. Also keep in mind that in addition to bad fats, unhealthy levels of triglycerides and cholesterol are influenced by an excessive intake of sugar and processed foods. Avoiding or drastically reducing your intake of these foods is strongly recommended.

When choosing oils for dressing salads and preparing low-heat dishes, olive, flaxseed, and canola oils should be your primary selections. For high-heat cooking, choose oils like sunflower, safflower, canola, peanut, and macadamia, which have high smoke points. This means they are able to withstand higher temperatures without breaking down, allowing food to cook more quickly and absorb less oil.

THE OMEGA GROUPS

Although a low-fat diet is generally considered healthier than one that is high in fat, our bodies require a certain amount of fat for proper growth and functioning. Like vitamins and minerals, a number of these fats either cannot be manufactured by the body or are unable to be produced in adequate amounts. Often referred to as "essential," these beneficial nutrients, which are found among the omega-3 and omega-6 fatty acid groups, must be obtained through diet or supplements.

Omega-3 fatty acids (also known as *n*-3 fatty acids) are polyunsaturated. They have been shown to reduce inflammation and help prevent chronic diseases, such as heart disease and arthritis. They are also important for brain health, as well as normal growth and development. The three major types are eicosapentaenoic acid, docosahexaenoic acid, and alpha-linolenic acid.

Eicosapentaenoic acid (EPA) has been found to have a positive effect on coronary heart disease, and in reducing high triglyceride levels, high blood pressure, and inflammation. It is found in krill and fatty cold-water fish like salmon, cod, herring, mackerel, and sardines. *Docosahexaenoic acid* (DHA) is good for your heart, as well as a healthy brain. Like EPA, it is found in krill and fatty cold-water fish. *Alpha-linolenic acid* (ALA) has been shown to reduce inflammation and prevent chronic diseases. Dietary sources are

plant based and include dark green leafy vegetables like kale and spinach, Brussels sprouts, soybeans, and walnuts. Oils such as soy, canola, and flaxseed are other sources. The body is able to convert only a small amount of ALA into EPA and DHA. Therefore, even if foods containing ALA are consumed in large quantities, it would still not be enough to get your recommended intake.

Like the omega-3s, omega-6 fatty acids (also known as *n*-6 fatty acids) are polyunsaturated fats. Along with omega-3s, they are important for proper brain functioning (especially during early development) and for the body's normal growth and development. They also play a role in stimulating skin and hair growth, maintaining healthy bones, and regulating metabolism. The main types of omega-6 fats are linoleic acid, gamma-linolenic acid, and arachidonic acid.

Linoleic acid comes primarily from plant-based oils, including safflower, corn, sunflower, and soybean. It is also plentiful in seeds and nuts, particularly sunflower seeds, pine nuts, and pecans. A small amount is found in milk and certain cheeses, like brie, blue, and Swiss. *Gamma-linolenic acid* (GLA) is found in borage oil, black currant oil, and evening primrose oil. *Arachidonic acid* (AA) comes primarily from meats and other animal products, including egg yolks.

Although omega-6 fats are beneficial in small amounts, too much (particularly arachidonic acid) can lead to chronic inflammation and a number of other health problems. For general good health, the intake of omega-6 fats and omega-3s should be in a proper ratio—between 3:1 and 6:1. Unfortunately, Americans tend to consume significantly more omega-6 fats than they need—for the standard American diet, that ratio is between 10:1 and 25:1. It's important to decrease the intake of omega-6s, while increasing the intake of omega-3s.

Another omega group—the omega-9 fatty acids—are monounsaturated fats that offer a variety of health benefits. Shown to increase beneficial HDL cholesterol and decrease harmful LDL cholesterol, omega-9s are important for heart health. *Oleic acid* is the main type of omega-9 commonly found in oils like canola and safflower. Unlike omega-3 and omega-6 fatty acids, the body is

able to produce omega-9s in adequate amounts, which are also beneficial when obtained from food sources.

All of the omega fatty acids, in proper amounts, are important for overall good health and nutrition.

OMEGA-3s AT THE CELLULAR LEVEL

One of the reasons omega-3 fatty acids are considered beneficial is their role in cells. Every human cell has a protective, two-layer permeable membrane called the *lipid bilayer* or *phospholipid bilayer.*

Cholesterol

Cholesterol is a soft, waxy substance that is found in the bloodstream and carried through the body in lipoprotein particles. It is both made by the body and consumed in animal foods. Although your body needs cholesterol, the intake of too much can clog your arteries, which means your heart will receive less blood and oxygen. This can result in serious cardiovascular problems.

There are two types of cholesterol: high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs). LDLs are known as "bad" (or "lousy") cholesterol because they can form as plaque along your arteries and increase your risk of heart disease. HDLs, on the other hand, are considered "good" (or "happy") cholesterol, whose main job is to collect, break down, and excrete the LDLs that are already in the body.

Therefore, your goal for optimal health should include a low LDL count and a high HDL count. Ideally, your total cholesterol (LDL plus HDL) should be under 200 milligrams per deciliter (mg/dL) and your HDL should be over 40 milligrams per deciliter (mg/dL).

If your cholesterol is high or has a sudden increase, adjusting your dietary habits is critical. Although a portion of cholesterol is due to heredity, limiting your intake of "bad" cholesterol foods is an important step in keeping the levels under control and lowering your risk for serious illness.

Each layer is made primarily of proteins, cholesterol, and fats in the form of phospholipids. Phospholipids are similar to triglycerides except that one of the three fatty acid units has been replaced with a molecule that contains phosphorus. These fats make up the structural component of the cell membranes, keeping them flexible and permeable. Maintaining this permeability is important so that nutrients are able to pass through the membranes into the cells. It also allows waste products to pass out of the cells. This is one of the reasons omega-3s, which have a flexible, long-chain structure, are so beneficial. They keep the cell membranes fluid and stable, preventing them from becoming too stiff and rigid for nutrients and waste to pass in and out as needed.

The type of fat you consume determines the type of fatty acid found in the cell membranes. A diet that is high in cholesterol and consisting mostly of saturated fat and trans-fatty acids results in cell membranes that tend to be rigid and less permeable than those found in a person whose diet includes optimal levels of unsaturated fatty acids.

Research has shown that the central factor in the development of virtually every disease is an alteration in cell membrane function. Without the right type of fats, cell membranes lose their ability to hold water and vital nutrients. And without healthy membranes, cells simply cannot function properly. They lose their ability to communicate with other cells and to be controlled by regulating hormones.

High levels of unhealthy fatty acids are also toxic. When this occurs, cells typically isolate them as phospholipids within the membranes. When stimulated, however, the fatty acids may be released, provoking a harmful inflammatory response from the body's immune system.

Omega-3 fats form an integral part of cell membranes that affects the optimal function of cell receptors. In addition to maintaining the structure of healthy cell membranes, omega-3s serve as the starting point for making hormones that regulate multiple body functions including blood clotting and inflammation. They also bind to cell receptors that regulate genetic function.

Scientific researchers have determined that omega-3 fats play

an important role in treating as well as reducing the risks of a wide range of diseases and illnesses caused by inflammation. Heart disease, cancer, Alzheimer's disease, and autoimmune disorders including thyroid issues, chronic pain, skin conditions, and lupus are just a few of these health concerns. The positive effects of omega 3s on these and other health concerns will be discussed in detail in later chapters. First, however, it is important to have an understanding of inflammation, which is at the root of most disorders.

INFLAMMATION AND HEALTH

Simply defined, inflammation is the body's natural protective response to an injury, irritation, or harmful pathogen. It is part of our body's defense system—its immune response. When anything harmful or irritating affects a part of the body, the body's biological response is to remove or destroy it. The inflammation that results is actually a sign that the body has begun the healing

Triglycerides

Triglycerides are a type of fat found in the blood and a major source of energy for the body. Excess calories from the food you eat are chemically converted into triglycerides, which are stored in fat cells if they are not used for energy. Hormones can also signal the release of triglycerides from fat cells to provide energy. In normal amounts, triglycerides are vital for good health. However, if you consume more calories than you expend—especially from a diet high in refined sugars and carbohydrates, or one that includes unhealthy fats, like saturated fats and trans fats—your triglyceride level will become too high.

High triglycerides are a major risk factor for heart disease, diabetes and insulin resistance, metabolic syndrome, liver disease, and pancreatitis. Elevated levels also contribute to atherosclerosis (hardening of the arteries), which increases the likelihood of a heart attack or stroke.

process. Be aware that inflammation does not mean infection. Infection is caused by a virus, bacterium, or fungus; inflammation is the body's response to it.

Inflammation can cause an acute or chronic reaction. Acute or short-term inflammation occurs as an immediate response and is quickly resolved. Chronic inflammation is long-term and the cause of numerous illnesses and conditions.

Acute Inflammation

Acute inflammation is the body's immediate response—it's defense reaction—to injuries or to harmful foreign invaders. The affected body part can display any or all of the following symptoms: swelling, redness, heat, pain, and /or loss of function.

Blood flow increases to the affected area, causing warmth and swelling. Pain results from the sensory nerves that are stretched during swelling. Loss of function results from damaged tissue, pain, or joint swelling. Damaged tissue is repaired by white blood cells, which engulf bacteria and other foreign particles.

Acute, short-term inflammation is beneficial. Let's say, for instance, you stub your toe. The tissues swell and the area becomes painful. Your response would be to go easy on that toe and protect it from further injury until the swelling goes down and the pain subsides. The discomfort you feel is like a red flag that keeps you mindful of the injury. This, of course, aids the healing process.

Signs and symptoms of acute inflammation occur quickly and tend to last only a few days, although in some cases they can persist for a few weeks. Some examples of health conditions or situations that can lead to acute inflammation include:

- Sore throat (from a cold or flu)
- Scratch/cut on the skin
- Appendicitis
- Bronchitis
- Dermatitis
- Meningitis (bacterial)
- Sinusitis
- Tonsillitis
- Trauma to the body

Acute inflammation is a natural response that begins the healing process. Under normal circumstances, when anything harmful causes an acute inflammatory response, that inflammation disappears relatively quickly as the affected area heals. If, however, the healing does not occur and the inflammation is continual, the condition becomes chronic, which can lead to much more serious health problems.

Chronic Inflammation

Diseases or health conditions that continue for a long time or recur over and over are considered chronic. Chronic, long-term inflammation is a continual response of the immune system to an ongoing problem—healing does not occur, but low-grade inflammation continues. As explained earlier, stubbing your toe will elicit an acute inflammatory response that will subside as the injury heals, but stubbing that same toe over and over and over again would cause the area more serious harm. In the same way, chronic inflammation, which can last for several months, years, or even a lifetime, can be extremely harmful. A common link to nearly every illness, from diabetes to cancer, chronic inflammation results from a failure to eliminate the cause of acute inflammation.

Keeping in mind that short-term inflammation is part of the healing process, in chronic illnesses, the body continually tries to heal the affected area, which, in turn, can lead to a deterioration of the tissue or a worsening of the condition. Unlike acute inflammation, which is caused by harmful bacteria or a tissue injury, chronic inflammation is caused by certain pathogens, infection with some types of viruses, persistent foreign bodies, or overactive immune system reactions. The outcome is the destruction of tissue, thickening and scarring of connective tissue (fibrosis), or the death of cells or tissues (necrosis).

Chronic inflammation is often painful, as in the case of autoimmune disorders like rheumatoid arthritis, because the swelling pushes against the sensitive nerve endings, which send pain signals to the brain. This can result in stiffness, discomfort, or even debilitation.

Chronic inflammation is not normal nor is it beneficial to the body. It has been implicated as the underlying cause of a number of serious health issues, with autoimmune conditions and heart disease the primary areas of concern.

Autoimmune Disorders

When the body's immune system detects harmful pathogens such as bacteria or viruses, it jumps into action to attack and destroy the unwelcomed intruders. In some cases, the immune system mistakenly views healthy tissues as harmful pathogens and attacks them. Through this misguided reaction, called an *autoimmune response,* the body actually attacks itself. Take type-1 diabetes, for example. Although there is no apparent intruder to fight off, the immune system mistakenly initiates an attack on the insulin-producing cells found in the pancreas. This stops the production of insulin by the body, causing increases in blood glucose. This type of autoimmune disease is commonly found in children and is treated by daily injections.

This harmful response triggers chronic inflammation and is the cause of hundreds of autoimmune diseases. The following list of selected autoimmune disorders indicates in each case how inflammation is involved.

- **Addison's disease.** Inflammation of the adrenal glands.
- **Allergies.** All allergies involve inflammation. For example, with asthma, the airways are inflamed. Hay fever causes inflammation of the membranes of the nose, ear, and throat.
- **Celiac disease.** Inflammation/destruction of the inner lining of the small intestine.
- **Crohn's disease.** Inflammation of the gastrointestinal tract.
- **Lupus.** Inflammation of the joints, lungs, heart, kidney, and skin.
- **Psoriasis.** Inflammation of the skin.
- **Psoriatic arthritis.** Inflammation of joints and the surrounding tissues.

- **Rheumatoid arthritis.** Inflammation of the joints, tissues surrounding the joints, and possibly other organs.
- **Vasculitis.** Inflammation of the blood vessels.

This abbreviated list of autoimmune disorders should serve as an indication of just how common inflammation is in wreaking havoc on good health.

Heart Disease

Chronic inflammation also plays a key role in heart disease, notably in the development and progression of a variety of cardiovascular conditions like coronary atherosclerosis and congestive heart failure. Inflammation is involved in the initiation of plaque buildup, which in turn causes the narrowing of arteries. In Chapter 4, you will find a detailed explanation of this process, which begins when the immune system detects an injury or damage to an arterial wall and then springs into action to heal it.

Unfortunately, chronic inflammation is not always detectable. We may notice the symptoms—and treat them—without getting to the underlying cause. This allows the inflammation to continue and undermine our health.

What does any of this have to do with omega-3s? Later chapters will offer detailed information on their role in improving or preventing specific health issues caused by chronic inflammation, but first, let's take a general look at how they are beneficial.

Omega-3s and Inflammation

A number of scientific studies have strongly indicated that omega-3 fatty acids play an important role in short-circuiting inflammation before it begins—or, at the very least, help resolve the inflammation before it becomes harmful.

One recent study published in the *Proceedings of the National Academy of Sciences* discovered that omega-3 fatty acids inhibit cyclooxygenase 2 (COX-2), an enzyme involved in the production of prostaglandin hormones, which spark inflammation. This reaction is similar to what happens when you take an aspirin or

ibuprofen, which disrupts the COX-2 signaling pathway, and causes a reduction of inflammation and pain.

As reported in the *Nature of Chemical Biology,* scientists at the University of Pittsburgh Schools of the Health Sciences published strong evidence that eating foods rich in omega-3 fatty acids or taking omega-3s as a dietary supplement reduces inflammation and lowers the risk of illness and death from cardiovascular and other inflammatory diseases.

The anti-inflammatory activity of omega-3 fatty acids has far-reaching positive effects. It can reduce joint pain, swelling, and stiffness in those who suffer from rheumatoid arthritis and other autoimmune disorders. It plays a part in decreasing high triglyceride levels, and increasing the good HDL cholesterol (which, in turn, helps lower bad LDL cholesterol). It also tends to lower blood pressure in people with hypertension, and helps prevent and treat atherosclerosis by slowing the development of plaque and blood clots, which can clog arteries.

The role of omega-3s in fighting destructive inflammation is nothing short of a miracle, but these fatty acids also play an important role in another area—our hormones.

HORMONAL IMBALANCE

Hormones are the body's chemical messengers. They travel through the bloodstream to control and regulate the activities of certain cells and organs. All of the hormones in your body are designed to interact with each other, and, when in proper balance, they play a part in helping you feel great and experience good health. Essential for growth and development, hormones also have an effect on other bodily functions, including metabolism, mood, sexual function, and reproduction.

A special group of cells known as the endocrine glands produce hormones. These glands, which are located in different areas of the body, secrete hormones into the circulatory system. The hormones then travel through the blood to specific organs or tissues and regulate their activity. The major glands of the endocrine system include the pituitary, hypothalamus, thymus, pineal, testes,

ovaries, thyroid, adrenals, parathyroid, and pancreas. Both men and women produce hormones in the same areas with one exception, the sexual organs. Additional male hormones are produced in the testes, while women's are produced in the ovaries.

Like musical notes in a symphony, hormones must work together and interact with each other in perfect harmony. They must also be produced in the appropriate amounts. If your body has too much or too little of a certain hormone, the feedback system will signal the appropriate gland or glands to correct the problem. But if this system has trouble maintaining the right levels, or if your body cannot clear them properly from the bloodstream, hormone imbalance will result—and this can lead to an endocrine disorder or disease.

Endocrine Disorders

There are thousands of different types of endocrine disorders, with diabetes and thyroid conditions among the most common. Of the many thyroid conditions, hypothyroidism and hyperthyroidism are common types. Levels of certain hormones, including those produced by the thyroid, can also be factors in depression and other mood disorders. Let's take a brief look at some of these conditions.

An overactive thyroid that produces too much thyroid hormone is the cause of *hyperthyroidism,* which leads to weight loss, accelerated heart rate, nervousness, and anxiety. Another thyroid issue involving hormone imbalance is *hypothyroidism.* The opposite of hyperthyroidism, this condition is caused by lower production of the thyroid hormone. Its common symptoms include weight gain, fatigue, dry skin, and forgetfulness. Some of these symptoms are also indications of depression.

While thyroid conditions such as hypothyroidism can be factors in depression, research has shown that some symptoms of depression are associated with other hormonal problems, such as those associated with the menstrual cycle. Hormones have also been implicated in *bipolar disorder* or *manic depression*—a mood disorder characterized by episodes of both extreme elation and deep depression.

Although these and other conditions of the endocrine system will be detailed later in the book, it's time for a brief overview on the role of omega-3 fats in their prevention and treatment.

Omega-3s and Hormone Imbalance

As you saw earlier in this chapter, omega-3s are critical for maintaining the structure of healthy cell membranes, keeping them flexible and permeable. In addition to their role at the cellular level, omega-3s also provide the starting point for making hormones. Two of the omega-3 fatty acids—EPA and DHA—are the building blocks for producing hormones that control immune function, and that regulate blood clotting, inflammation, and the contraction and relaxation of artery walls. Without these beneficial fats, the body won't be able to maintain healthy cells, nor will it have what it needs for proper hormone production.

Increasingly, researchers are discovering that omega-3 fatty acids may be effective in alleviating depression and other mood disorders without the dangerous side effects that are typically found with pharmaceutical treatments. Omega-3s have also been effective in preventing cognitive decline, increasing one's attention span, and reducing aggression.

CONCLUSION

A tremendous amount of research has been done on the significant benefits of omega-3 fatty acids, with increasing evidence of their link in the treatment and prevention of a host of illnesses. While this chapter has provided an overview of omega-3s along with a general look at their role in good health, the chapters that follow will offer more specific information.

Along with discovering how vital omega-3s are for good health, you will also learn the best way to obtain them. While fish oil has long been considered the best dietary supplement for these beneficial nutrients, krill oil has proven to be an even better source, a superior choice.