A POUND OF PREVENTION FOR A HEALTHIER LIFE

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How and Why Avoiding Environmental Exposures to Toxic Chemicals and Other Free Radical Sources Reduces Oxidative Stress and Lowers the Odds of Getting Sick

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A Pound of Prevention for a Healthier Life: How and Why Avoiding Environmental Exposures to Toxic Chemicals and Other Free Radical Sources Reduces Oxidative Stress and Lowers the Odds of Getting Sick

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To my wife Gail, thanks for the inspiration

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CHAPTER ONE

INTRODUCTION

Why this book? There's the old adage when it comes to disease, "An ounce of prevention is worth a pound of cure." This book has a pound and more of prevention. Why do we need so much prevention? Humankind has accomplished remarkable things, but in doing so has disrupted the natural order of things and put itself at odds with Mother Nature. We have polluted our environment with toxic chemicals to the point where the air we breathe, the water we drink, the foods we eat, the clothes we wear, the homes we live in and lifestyles we lead are making us sicker than we have ever been since we evolved from the apes.

My more than 40 years of study, research and investigation have shown that most human disease is caused by environmental exposures to toxins, by lifestyle choices such as unhealthy diet or smoking tobacco as well as by emotional stress. Much of this disease is preventable and the symptoms of illnesses can be reduced. This book was written to show how and why people get sick, how the likelihood of disease onset can be predicted even before symptoms appear, what can be done do lower the incidence of disease for ourselves and for humanity as a whole and what preventative measures can be taken to keep us from getting sick. The studies and case histories cited in this book have all been published in peer reviewed scientific and medical journals, however, the names of the people and their locations have been changed to protect their privacy.

About 20 years ago, I began to research cancer clusters. I couldn't understand why some people who were exposed to toxic chemicals at levels presumed safe nevertheless got sick. Why was it that people who had identical levels of exposures to the same chemicals had different outcomes: some got cancer and others didn't? Subsequently, I was further challenged by other reports of seemingly strange disease statistics. Why do people with Rosacea have a 35% greater chance of developing Parkinson's Disease than everyone else? Why do people who take Statins to lower cholesterol for stroke and heart attack prevention have a much higher incidence of type 2 diabetes that those who don't? Why are those exposed to chlorinated pesticides like DDT more likely to develop cancer that those not so exposed?

These questions led me to a remarkable, yet simple, explanation: Most disease is caused by oxidative stress—a state in which the body's natural ability to combat the assault of free radicals, chemicals that literally tear cells, protein and DNA apart. In the modern world we are exposed to toxic chemicals and other factors that raise disease causing oxidative stress in the body to levels not previously experienced by man.

Before looking the sources of these chemicals and other factors and how disease can be largely prevented, let us look briefly at the history of disease prevalence. Disease cannot be completely eliminated because we are all different genetically. We vary in our ability to combat oxidative stress and hence in our resistance to developing and fighting disease. We can, however, take steps to dramatically reduce the incidence of disease.

Modern medicine can successfully treat disease and prolong life. For example, childhood leukemia, which was once almost always fatal, now has a 90% cure rate. People today can expect to live more than 15 years longer than was the case in 1940. Despite statistics such as these, we in the United States, as in other industrialized nations, are living longer but sicker than ever before, and getting sick at younger ages than previously. Strokes, heart diseases and colorectal cancers, once rare in people under the age of 50, are now occurring much more commonly in younger people. Those of us who fall ill with one disease are much more likely to come down with other diseases than those who are not sick at all. Why do the sick get sicker and why is the average American now ill with four or more different non-infectious diseases? To explain this phenomenon, let's look at a little history.

Once, there was a lovely planet called Earth. It had evolved to where it exquisitely supported the lives of countless species of animals and plants in perfect harmony. Abundant species of fish filled oceans, sparkling lakes and rivers. Teeming forests, towering mountains and rich-soiled grassy flatlands provided intertwined ecosystems that made for game and farming opportunities which allowed a massive population of humans to flourish and prosper. People breathed clean air, drank water uncontaminated with chemicals, and consumed food devoid of pesticides, chemical fertilizers, antibiotics and growth hormones. The human occupants of this idyllic planet also responsibly harnessed its vast resources for energy production such that these resources were not permanently depleted and minimally impacted the total environment. To be sure, people lived much shorter lives than we do today. With only crude medical care available, those who were injured or contracted disease often died young. Though people did not live nearly as long as they do today, they had fewer diseases and generally lived healthier.

The coming of the Industrial Revolution brought the beginning of change. Large aggregates of people began assembling in small geographic areas (cities) that could not sustain a constant healthy environment. The massive burning of carbon (wood, coal and petroleum), huge manufacturing facilities, large-scale mining and synthetic chemical production all contaminated the air, led to poisoning of the waters and ultimately gave rise to the production of foods deliberately contaminated with synthetic chemicals which were adulterated to be cheaper to produce, have longer shelf lives and which were decorated with artificial colorants and flavors to make them resemble healthy foods.

Though the Earth's environment was much more pristine up until the time of the Industrial Revolution, that is not to say that people were not exposed to pollutants. Since the first time people starting burning wood, coal, and other carbon containing fuels they were exposed to human-generated toxic chemicals. People were also always exposed to these chemicals from naturally occurring fires due to lightning strikes. These exposures, however, were miniscule compared with the exposures that started with the massive energy production required to power the Industrial Revolution and with the introduction of synthetic chemicals which ensued. Let us briefly address these.

From 1776 to 2015 the energy produced worldwide has increased by 3600% and in the United States, the increase was more than twice the world increase. Our bodies can handle exposures to small amounts of toxic chemicals by metabolizing and/or eliminating them. However, the resultant production of toxic chemicals from massive combustion of coal, oil and natural gas and the intake of large quantities of toxic synthetic chemicals has led to exposure levels that, in many instances, are too great for our bodies to handle.

Chemical production in the world in the same 1776 to 2015 time frame increased by an astounding 33,380,000 percent! The number of chemicals produced has grown from single digit numbers to an estimated 140,000 in that time frame. All of the chemicals produced at the time of the American Revolution were naturally occurring ones. Today, however, it is estimated that 85,000 different synthetic (man made) chemicals are being produced and released into our environment annually. The human body evolved in a natural environment. Today it is being bombarded by chemicals with which it has no genetic experience and is unable to rid itself of.

Let us briefly look at the history of this invasion of our bodies by chemicals. As mentioned above, humans have always been exposed to toxic chemicals, but these exposures were almost inconsequential compared with those the Industrial Revolution, brought about through large-scale manufacturing of chemicals. As the industrial revolution progressed, ever increasing quantities of naturally occurring chemicals were produced, and starting in the middle of the 1800s, production of synthetic chemicals with which the body had no experience dramatically increased. Large scale use of natural chemicals was initially used in mining and smelting of metals such as iron, in textile and paper manufacturing and in crop fertilization. By the late 1800s, synthetic chemicals such as azo dyes, now well known to be carcinogenic, had been introduced for textile dying. Other toxic synthetic chemical use quickly followed. Synthetic fibers, plastics, packaging materials for foods, and pharmaceuticals are just a very few of the uses found for synthetic chemicals unknown in the environment but with toxic consequences.

The following timeline is an indicator of the growth of chemical use that resulted from the Industrial Revolution.

*1746 Introduction of the Chamber Process for the large scale production of sulfuric acid, which until this day is the chemical produced in greatest volume with the exception of water. This achievement in many ways triggered the chemical revolution.

*1824 The first man made carbon containing chemical, oxalic acid, a compound still in use to this day for rust removal, as a rat poison and other applications. This was a huge advance in chemistry, for it introduced the notion that carbon-containing compounds, which are the back bones of the chemical revolution could be made by man.

*1828 The first synthesis of urea, a component of urine. This represented a severe blow to vitalism, a belief at the time that organic chemicals (chemicals from living things) had a vital force and could only be made by biological sources. This discovery opened the door to the chemical revolution which ensued.

*1856 Production of the first synthetic dyes to replace those derived from plants. This ultimately led to the large scale introduction of cancer causing azo dyes that have been also been associated with hyperactivity in children. Though initially used in textiles, these compounds are still used today as colorants in foods.

*1856 The synthesis of Parkesine, the world's first man-made plastic.

*1864 First production of chlorine. The Chloralkali process was ultimately introduced in the 1890s for the large scale production of chlorine. This, in turn, led to wide scale water disinfection, and the production of pesticides, but also resulted in the release of toxic mercury into rivers, streams, lakes and the ocean.

*1872 The first synthesis of PVC (polyvinylchloride) now widely used in countless plastic applications, including piping, plastic pails and shower curtains.

*1873 The synthesis of Acetaminophen. First used medically in 1893 as a replacement for aspirin. It went on sale in the United States in 1955 as "Tylenol."

*1874 The first synthesis of the insecticide DDT. Its pesticide properties were discovered in 1939 and its discoverer given a Nobel Prize in 1948. DDT was banned in the United States following the publication of Rachel Carson's book, "Silent Spring" in 1962.

*1907 Bakelite plastic introduced, making possible the manufacture of strong structural components.

*1909 The introduction of the Haber Process to convert atmospheric nitrogen into ammonia ultimately used for the production of synthetic fertilizers. It was also used to produce nitric acid, a precursor to the manufacture of munitions.

*1911 Arsphenamine, the first man made antibiotic was developed.

*1927 The introduction of nylon, a synthetic replacement for silk.

*1930 Polystyrene invented. Widely known as the styrofoam used in packaging material and as insulated food containers.

*1931 PCBs (polychlorinated biphenyls) introduced into the marketplace for applications in electrical insulators, adhesives, paints, resins and numerous other applications. These known cancer causing chemicals were banned in 1979, but still are ubiquitous almost everywhere in the world as they are carried by winds, ocean currents and through the food chains of plants and animals.

*1933 Polyethylene introduced. Widely used as plastic sheeting and in packaging containers.

*1941 PET (polyethylene terephthalate) plastic introduced. Now the world's most widely used plastic beverage container material.

Miraculous technical advances of modern society, including the advent of disease fighting "miracle drugs," landing a man on the moon, the ability to multiply crop yields, and the proliferation of high power computers and other electronic devices, for example, have all been accompanied by huge increases in the use of synthetic chemicals. New uses for chemicals are constantly being found, an example being the use of rare earth metals which have made the large scale manufacturing of televisions, computers, cell phones and medical diagnostic devices possible. Another example is the finding of new uses for nanoparticles, extremely small, and oftentimes very toxic, particles that are readily absorbed through our lungs and carried by the blood into our brains.

The second major contributor to the increase in disease prevalence brought about by the Industrial Revolution is the greatly increased energy production required to power it. The first large scale energy production fuel was coal. With the discovery of oil and natural gas reserves in multiple locations around the world, petrochemicals soon eclipsed coal as the primary energy fuels. The amount of energy produced by burning of these fossil fuels increased by 10,000 fold from 1900 to 2010, accompanied by a corresponding increase in pollutants released into our environment. This has been accompanied by global warming that has resulted in rising sea levels, a sharp increase in violent storms that contribute to the spread of disease and extinction of numerous animal and plant species that are essential for a balanced environment and our well being.

The increase in disease has closely paralleled the advance of the Industrial Revolution in Europe and America. The introduction of large volumes of man made toxic chemicals and the enormous increase in energy generated occurred relatively slowly in the Western World over three centuries, as did the corresponding increase in disease levels. China was a largely agrarian society until the 1950's. Following the Communist takeover in 1949, China very rapidly industrialized to where it has reached a level of chemical use equaling that in the West in only a few decades. Correspondingly, environmental pollution and the onset of much disease has mirrored this industrialization in China as well, to where disease levels of East and West are now similar. The "Chinese Experiment" has served to demonstrate that there is indeed a very close association between the increased disease and increased chemical use.

As the Industrial Revolution "advanced," human disease and suffering advanced with it. Diseases that were barely known became more prevalent and continued to grow dramatically. Starting at the turn of the twentieth century, scientists and physicians began observing and reporting on the toxic effects of chemicals on humans. As the twentieth century progressed and continuing to date, ever increasing numbers of chemicals have been released into our environment, to where there are now more than 140,000 unnatural chemicals, only a few of which have been tested for toxicity, contaminating our planet, and new ones being introduced on a daily basis. The growth in the number of people sick with diseases that were once rare; diabetes, autism and childhood cancers, for example, has grown and continues to grow as the pollution of our planet increases.

This book identifies the causes of disease. It also describes how and why these causes induce disease, the steps that can be taken by individuals and by society as a whole to greatly reduce the prevalence of disease world wide and what we individually can do predict and thereby prevent the onset of much disease.

CHAPTER TWO

OXIDATIVE STRESS AND DISEASE

> *"Visiting the iniquity of the fathers on the children to the third and fourth generation."*

The bible addresses this warning to sinners (Numbers 14:18). Toxic chemical exposure can have a similar affect on future generations.

Oxidative Stress

Virtually all illnesses with the exception of genetic diseases are caused by our bodies' being stressed by too many very reactive chemicals called free radicals. Free radicals are not college students run amok during campus protests, nor are they are all bad. They are very reactive chemicals formed when molecules in our bodies are partially torn apart and are essential for normal body functions such as food digestion and energy production. Free radicals, however, are also produced when the body is exposed to toxic chemicals, radiation, emotional stress, physical injury and other sources as discussed in chapters 4 and 5. These unnatural causes give rise to an overabundance of free radicals and overwhelm the body's ability to combat them. The body naturally reacts to an overproduction of free radicals by using antioxidants, such as vitamins C and E derived from food (primarily fruits and vegetables) and enzymes made by the body, to neutralize and lower them to healthy levels. However, when the number of free radicals being produced in the body is too great to be controlled by antioxidants, our bodies are over stressed and a state of over abundance of free radicals, called oxidative stress, exists. Under oxidative stress, free radicals act like millions of little spears that jab holes in body cells, trigger unwanted chemical reactions and attack cell membranes, body proteins and DNA. This results in the onset of disease, premature aging, organ failure and, in the extreme, to death.

Though exposure to environmental chemicals is the greatest cause of oxidative stress, it is very important to understand that no matter what the cause, the effects of oxidative stress on the body are the same and that total oxidative stress from all sources combined is what makes us sick. So, for example, even though exposure to environmental chemicals alone may not be high enough to produce a level of oxidative stress sufficient to make us sick, the combination of chemical exposure and poor diet choice or emotional stress choice combined chemical exposure very well can.

Our bodies are wonderfully equipped to mend themselves and recover from oxidative stress. When we are under constant (chronic) attack by oxidative stress, however, our bodies become overwhelmed and we get sick. Some of us able to withstand oxidative stress to a greater extent than others. Also, the same sources of oxidative stress can cause different diseases in different people. For example, though tobacco smoke is a huge trigger of oxidative stress that is known to cause lung cancer and heart disease, not all smokers develop lung cancer and heart disease. Some develop only lung cancer, some heart disease while others may develop both or have neither. Certainly our genetic makeup has a lot to do with our resistances to disease, but as will be seen below, excessive oxidative stress is responsible for virtually all disease.

Before looking at oxidative stress caused disease, we need to briefly consider our body's makeup. We have ten primary parts, known as systems, with each system composed of parts known as organs. These systems and their primary organs are:

Circulatory System

The circulatory system is made up of the following organs:

- The heart
- Arteries
- Veins
- Capillaries

These are responsible for pumping and moving blood all around the body, delivering oxygen and nutrients and removing carbon dioxide and waste products.

Respiratory System

The respiratory system is the vehicle for taking in and absorbing oxygen, as well as removing carbon dioxide. It includes the following organs:

- Nose
- Mouth
- Trachea
- Lungs

Musculoskeletal System

The musculoskeletal system is what gives us our solid structure and enables us to move. It is comprised of the following parts:

- Bones
- Ligaments
- Tendons
- Cartilage
- Muscles

Nervous System

The nervous system has three parts. They are:

- Brain
- Spinal Cord
- Peripheral nerves.

The brain and spinal cord make up the central nervous system (CNS) which control all life functions. The peripheral nerves serve to transmit messages to and from the CNS and to provide us with our five senses of sight, hearing, smell, taste and touch.

Endocrine System

The endocrine system is made up of hormone producing glands that control essential body functions such as growth, healthy functioning and reproduction. The major glands of the endocrine systems include:

- Thyroid
- Pituitary
- Thyroid
- Parathyroid
- Pineal
- Hypothalamus
- Pancreas
- Adrenals
- Male and female reproductive

Digestive System

The digestive system is made up of the following:

- Mouth
- Esophagus
- Stomach
- Liver
- Gall bladder
- Small intestine
- Large intestine
- Rectum
- Anus

These provide the chemical and mechanical processes that digest food and eliminate waste.

Integumentary System

The integumentary system organs include:

- Skin
- Hair
- Sweat glands

These provide protection and temperature control in the body.

Urinary System

The urinary system contains:

- Kidneys
- Urethras
- Bladder
- Urethra
- Penis (in men)

These provide blood filtration of toxins, as well as production, storage and elimination of urine.

Immune System

Immune System is our department of defense for fighting off and curing disease. Its organs include:

- Thymus
- Bone Marrow
- Spleen
- Tonsils
- Lymph vessels and node
- Adenoids
- Skin
- Liver

These, which include our white blood cells, protect the body against attack by disease-causing agents.

Reproductive Systems

The reproductive Systems includes the male and female organs necessary for conceiving and delivering babies.

Female reproductive organs include:

- Vagina
- Uterus

- Fallopian tubes
- Ovaries

Male reproductive organs include:

- Penis
- Testes
- Epididymis
- Sperm ducts
- Ejaculatory duct
- Urethra
- Prostate gland

Cells

Each organ is composed of building blocks called cells, of which there are approximately 37.2 trillion (million billion) in our bodies. There are approximately 200 different kinds of cells in our bodies and although the cells of each organ differ in their composition and structure, they all have many similarities. Cells are the ultimate targets of oxidative stress. These are some of their characteristics:

- Cells do not live as isolated entities. They communicate, share and cooperate with each other.
- Cells require constant nutrition and a constant supply of oxygen or they will die.
- Cells immediately identify disease causing organisms (such as bacteria and viruses) and immediately take steps to defend against attack by these.
- Cells also identify chemical toxins and quickly act to defend themselves against attack by these as well.
- Cells have a limited life cycle. They die and are replaced by other identical cells that maintain the integrity of the organ of which they are a part of.
- Each cell is surrounded by a fatty membrane which acts as a wall that protects it from attack by harmful chemicals. Cell membranes can be considered as cells' protectors and doorkeepers, allowing oxygen and

nutrients in, waste products to leave and acting as barriers that keep unwanted chemicals out.

- Though the membranes of all cells are made up primarily of fatty material, they differ enough from organ to organ so as to allow different materials to enter and leave the cells.
- The interiors of cells contain proteins, enzymes, energy producing parts (mitochondria) and DNA which are essential for their functioning.
- Each different type of cell contains unique membranes, proteins and enzymes and other essential parts that are different from other cell types.
- All cells are attacked by free radicals, but some free radicals attack some cells to a greater extent than other free radicals do.
- Free radicals attack cells several ways. The first of these is by tearing apart the membranes that surround and protect cells from harmful chemicals. Free radicals can be thought of as lances that tear cell membranes apart, thus allowing toxic chemicals to flow freely into the cells. Despite the differences in the composition of the various cell membranes, all produce a chemical called MDA (malondialdehyde) when torn apart by free radicals. Measuring the blood level of MDA is a reliable way of determining a person's oxidative stress level. Inside the cells, free radicals attack sugars and proteins, break enzymes apart, thereby preventing them from doing their jobs, interfere with cell communication by damaging receptor sites and damage DNA by breaking pieces off of it. These effects lead to numerous diseases including Alzheimer's Disease, Autism, cancer, heart disease, diabetes and many others that are discussed below.

Though almost all disease can be attributed to excessive oxidative stress, as stated above, some oxidative stress some is essential. The body is wonderfully equipped to handle short term moderate amounts of oxidative stress, but is overwhelmed by both high short term levels of oxidative stress as well as by long term (chronic) moderate oxidative stress. We can compare this to building sand castles on the beach in front of an incoming tide. A few laps of the water do minimal damage that can be easily repaired, but a pounding of strong waves or a continued lapping of many weaker ones ultimately damages the castle beyond repair.

In the body, intense exercise leads to short term oxidative stress whose symptoms include rapid heart beat and huffing and puffing. Upon resting, the body recovers easily from such exertion and is generally well served by it. Constant elevated heart and breathing rates when caused by disease, however, are deleterious to one's health.

What Causes Oxidative Stress?

All of the body's organs and systems can be attacked by oxidative stress. When this happens, disease onset occurs. There are many causes of oxidative stress. These include:

- Exposure to toxic chemicals
- Exposure to radiation
- Inflammation
- Injury (trauma)
- Prescription and recreational drugs
- Some foods—including sugar, fat, salt and processed meats
- Tobacco smoke—which contains numerous toxins and carcinogens
- Preservatives used in foods and cosmetics
- Being ill with an infectious disease such as the flu and common cold or with an environmental disease such as autism, Alzheimer's disease, diabetes or cancer
- Emotional stress

These causes of oxidative stress are addressed in chapters 3 through 6.

As stated above, some free radicals preferentially attack cells in some organs more that cells in other organs. For example, excessive exposure to DDE, a chemical that is produced in the environment when the pesticide DDT is broken apart, is more likely to lead to type 2 diabetes than other diseases. That is not to say that DDE doesn't cause other diseases, it does, but for some still unknown reason is more likely to attack the cells in the pancreas and cause diabetes.

There are two possible explanations for this is the fact. First, though all cell membranes are largely made up of fatty acids, the exact nature of the fatty acid composition varies from cell type to cell type. We can think of this as rock walls made up of different arrangements of large and small stones. Apparently, these differences are responsible for making particular cells more open to attack by some chemicals, for example, and not others. In the stone wall analogy, some stones would be more easily removed than others, thus weakening the wall differently and thus making it more susceptible to penetration. A second explanation is that in the real world, unlike in the laboratory, people are almost never exposed to single chemicals. Exposures to mixtures of chemicals are well known to cause toxic effects that are different from those of the individual components of such mixtures. Here is one such example.

Cindy Whiteside, Pat Conlon and Phoebe Collins* were office workers in an central Michigan insurance company office. One early May morning, the exterior of the building they were working in was sprayed with a mixture of herbicides and insecticides to protect against weeds and insect infestation. Within a few minutes of the application of the chemical mixture, all three women developed breathing problems. None of them had ever previously had breathing difficulties, allergies or asthmatic symptoms. All three were hospitalized and treated. Whereas Pat and Phoebe completely recovered, Cindy did not and was left with a permanent asthmatic condition. Investigation of the incident revealed that none of the chemicals applied to the exterior of the building were known to have respiratory effects on people. Also, given the known toxic effects of the chemicals and the small amounts of these that were chemicals used, the locations where they were applied and the circulation of air in and out of the building, no health effects of any kind should have resulted. The only explanation for what clearly occurred is that the mixture of chemicals used caused an unexpected effect.

*The names and locations of all subjects cited in this book have been changed to protect the privacy of the people involved.

Of all the causes of increased oxidative stress, chemical exposure is by far the one most responsible, and mixtures of chemicals are often more dangerous than single chemicals. So even though the exposures to mixtures of chemicals known to cause a particular disease may be at levels so low that each alone would not cause that disease, exposures to the mixtures of these can bring on disease. Such effects are called synergistic effects. An example of a synergistic effect of two environmental pollutants is that of the widespread pollutant dioxin and the pesticide endosulfan. Whereas very low levels of each do not cause cell death, mixtures of the two at such low levels have been shown to undermine numerous cell functions and lead to cell death.

As stated above and worth repeating, elevated oxidative stress can come from one source, high levels of a single chemical, for example. It, however,